

RADIO NEWS

TECH.
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JULY
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July-Dec.

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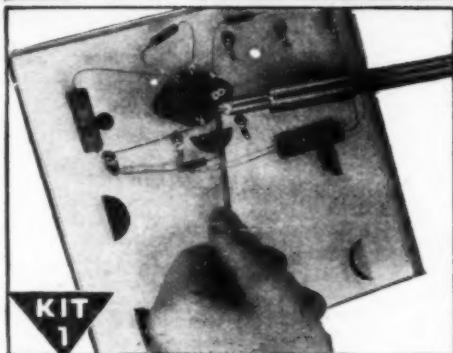
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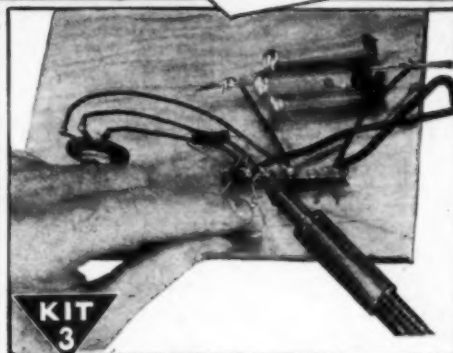
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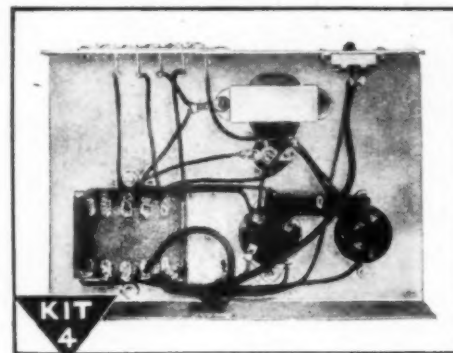
KIT 1
I send you Soldering Equipment and Radio parts; show you how to do Radio soldering; how to mount and connect Radio parts; give you practical experience.



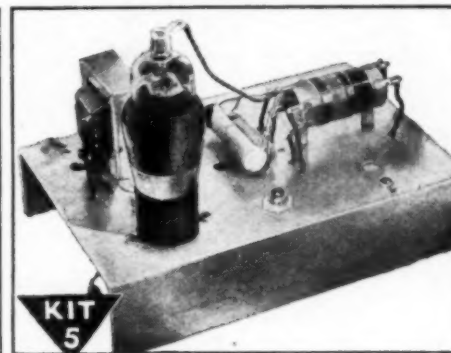
KIT 2
Early in my course I show you how to build this N. R. I. Tester with parts I send. It soon helps you fix neighborhood Radios and earn EXTRA money in spare time.



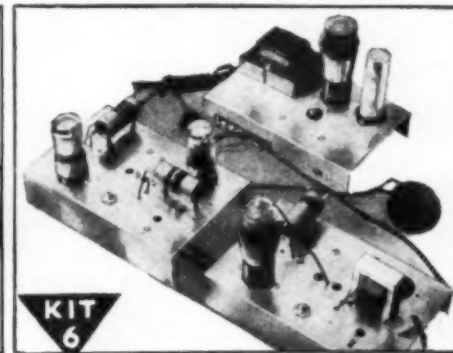
KIT 3
You get parts to build Radio Circuits; then test them; see how they work, learn how to design special circuits; how to locate and repair circuit defects.



KIT 4
You get parts to build this Vacuum Tube Power Pack; make changes which give you experience with packs of many kinds; learn to correct power pack troubles.



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THE COVER: Field Day of Eastern Massachusetts Amateur Radio Association brings out Harrison Faulkner, W1BSY, Bill Dean, W1RQ and Ray Morrison, W1KON. They have set up their rigs at the Winchester Country Club, one of the locations for Field Day activities. Photo by Walter Steinhard.

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RADIO NEWS

Going places
(AGAIN)

hallicrafters



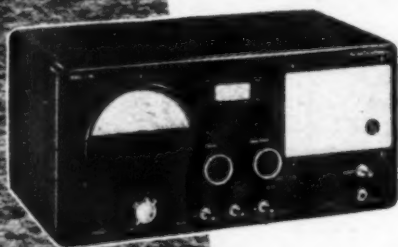
Hallicrafters famous radio equipment, sold and distributed around the world before the war and used with superb effectiveness in every theater during the war is once again on the move. Watch for latest details of the Gatti-Hallicrafters mobile radio equipped expedition to the Mountains of the Moon in deepest Africa—a new and exciting test for the ingenuity of hams and the performance of Hallicrafters equipment.

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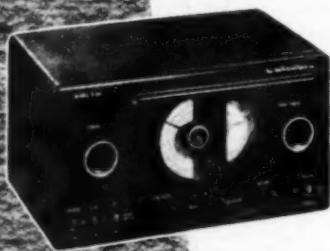
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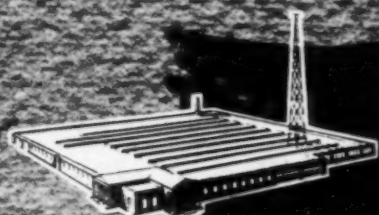


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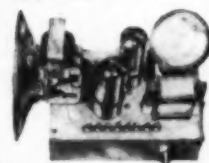
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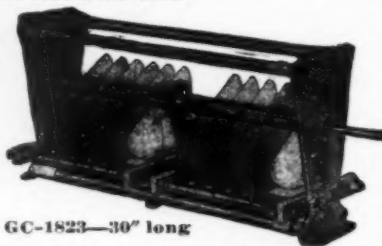
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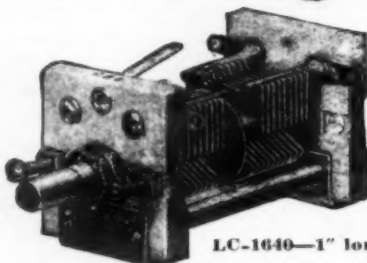


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For the RECORD.

• BY THE EDITOR

THE "Test Clinic" set up in Philadelphia recently promises to throw much light on the proverbial problem of prestige for the radio serviceman. During the Parts Show held in Chicago last May we found the entire industry cognizant of the importance of the local radio serviceman to his community. Manufacturers took keen interest in the present and future welfare of these technicians. Without exception manufacturers took an unselfish viewpoint of the problem and came through with some very concrete plans for the benefit of the radio serviceman.

For example, the Chairman of the Coordinating Committee of the Radio Parts Industry, Herb Clough, announced plans for industry help to radio servicemen and radio service organizations to round out a complete program for mutual cooperation between all segments of the Parts Industry. Bob Baggs, Chairman of the Merchandising Subcommittee on Parts, also came forth with the following:

"It should be very emphatically pointed out that the program now planned definitely does not contemplate any domination of servicemen or of service groups by any manufacturer or any organization serving the radio industry. Basically, the program is designed to assist present and future service organizations to carry out their own programs and to be assisted whenever possible by other operating industry organizations."

During the Trade Show we attended several meetings and found that the feeling of the radio manufacturers to such contributions made by all segments of the industry would naturally encourage the improvement of local service for the benefit of service technicians, distributors, and all other members of the industry. It was expected that the clinical approach (tested at Philadelphia) would point the way toward helping the serviceman raise the standards of his profession and encourage the adoption of sound business and merchandising practices in the radio service industry. The results would increase the business stature and prestige of the service technician in his own community and would give him a professional standing on a par with physicians, dentists and other specialized technicians.

The finale of the 1947 Radio Parts Show was "Open House Day." We talked to many visiting servicemen from in and around Chicago and they heartily agreed with the program as recommended by the various subcommittees. We also talked to Dave Krantz, President of PRSMA, and he analyzed the situation as follows:

"I feel that the program, as tentatively planned, has excellent possibilities not only for improving the lot of the service technician and businessman but also for erasing inequities and bad practices which have been unhealthy for the entire industry."

He was delighted to find that members of the committee are adamant in their insistence that these clinics be carried out by the industry as a whole rather than by one organization or by any one segment of the industry. Said Krantz, "Radio service has been the industry's unwanted stepchild for a good many years and it would be unfortunate if one organization tried to dominate other service organizations."

We are convinced, after talking to these men, that something constructive is being done to really help the serviceman in his individual local community to compete on a prestige basis with other professionals engaged in making their living in the same town. One prominent manufacturer, for example, has prepared and distributed spot radio announcements designed to create in the minds of the consumers the fact that they have, at their fingertips, qualified technicians eager, willing and quite capable of taking care of all of their radio and television equipment.

Mr. A. R. Guild, Secretary of the Federation of Radio Servicemen's Associations of Pennsylvania, tells us that the response to his letter (RADIO NEWS, May 1947, p. 138) has been so gratifying that it has been decided to hold a convention for all servicemen east of the Mississippi. The affair will be backed by RMA and NEDA and will be held in Philadelphia on September 18th to 21st, inclusive.

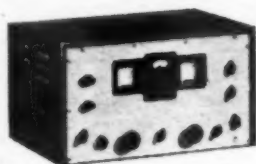
Those of you who are able to attend should not miss the opportunity to discuss your problems with the manufacturers, distributors and servicemen who will be there. New service instruments will be displayed and it is planned that manufacturers will demonstrate their units to show how valuable time can be saved through the proper use of specialized electronic test gear for the radio man.

We invite suggestions and comments from our servicemen readers on matters pertaining to their particular welfare. We should like to know what your thoughts are regarding the formation of local organizations in your community and we should also like to know what the manufacturer can best do to serve you. We will compile these suggestions and present them to the industry at the earliest possible moment. See you in Philly next September. O.R.

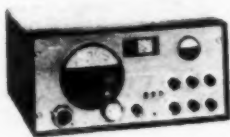
RADIO NEWS



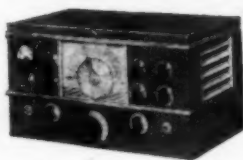
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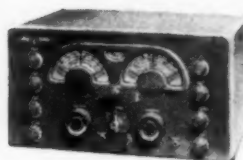
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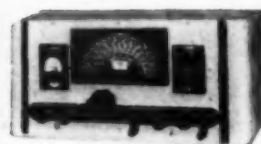
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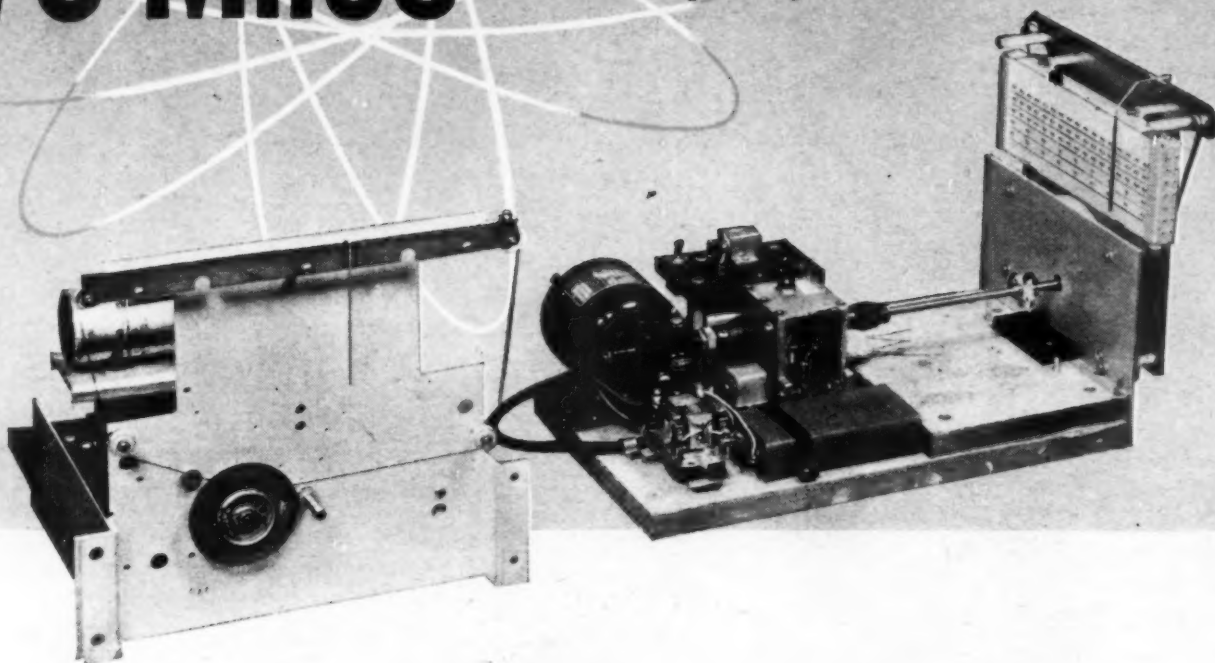
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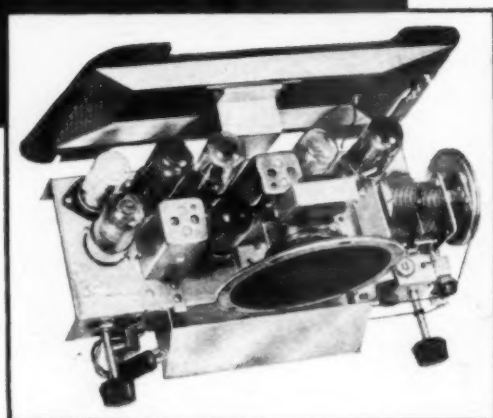
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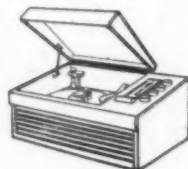
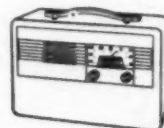
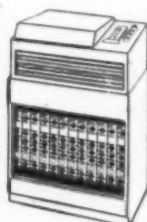
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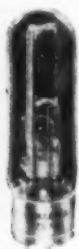
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Spot Radio News

★ Presenting latest information on the Radio Industry.

By **FRED HAMLIN**

Washington Editor, RADIO NEWS

PROSPERITY may still be only in the talk stage in many another U.S. industry, but in radio it is a booming reality. That, in sum, is the round-up on radio spot news at the beginning of the summer season, and all indications are that reports will continue good for the rest of the year, if not through 1948. Production troubles seem to be ironing out. Supplies are becoming more and more ample. When the Radio Manufacturers Association predicted that its annual convention in Chicago in early June would be the largest ever, the prediction turned out to be an understatement. Full, steady employment seemed assured all along the line. AM is doing fine, FM is growing lustily, production of auto, television and mobile sets is progressing well. . . .

STILL MOST ENTHUSIASTIC about their progress are the FM leaders. J. N. (Bill) Bailey, executive director of the FM Association, recently reported spectacular gains and predicted need for new personnel as stations get into operation. Number of stations on the air had gone beyond the two hundred mark by the beginning of summer, with construction of more than six hundred additional stations already okayed by the Federal Communications Commission. Six months ago there were only 66 stations on the air. "By the end of 1948," Bailey predicts, "we fully expect that from 1500 to 2000 FM stations will be in operation." There will also be jobs for those qualified—at the rate, he estimates, of 25 persons per full-time station. But practical training is almost mandatory, Bailey believes. He criticizes schools which emphasize dramatics and fail to teach salesmanship, promotion, and general business practices. "I would urge every university to offer complete radio courses, and I don't mean teaching air personality alone," he says. . . .

PRODUCTION, from all indications, will continue without major labor troubles. So successful have been recent RMA seminars on labor relations that outside industry observers have come to watch them more and more closely, and to attend. Typical of the spirit of the meetings was one held recently in New York at which Edgar L. Warren, director of the U.S. Conciliation Service, Department of Labor,

was the principal speaker. Mr. Warren probably expressed the consensus of the radio industry when he declared that "we are over the hump" in industrial disputes. He added that he believed both labor and management are sincerely trying to adjust their differences.

WITH THE LABOR-MANAGEMENT skies reasonably clear—for the time being—production totals continue to break records. Gone is what appeared to be a chronic complaint—shortage of tube supplies. Reports M. F. Balcom of RMA's tube division: 1947's first-quarter production licked the shortage. Tubes are now being produced to meet all domestic needs and provide a supply for export. Figures bear out the statement. Receiving tube production was up again in March to 19,048,950, bringing the first-quarter total to 57,548,414. March production was almost a million ahead of February. Breakdown of the figures show that most of the March production—more than 13,000,000 units—went for new sets. Some 3,700,000 were for replacements, 2,069,000 for export, more than 22,500 for government agencies. . . . Television sets led the receiver production news for the first quarter, as reported by RMA manufacturers. Total for all sets was 4,231,415, with a steady increase in the production of FM's and radio-phonograph consoles as well. A total of 18,329 television units was reported. Table models were off from 1946 figures, with consoles stronger as supplies became available. Auto radios were up to 567,736 and portable receivers totaled 482,569. In the television field, the accent was on table models, with 15,498 produced in the quarter, as compared to 2761 consoles and 56 radio-phonograph combinations. In addition, 14 converters were produced.

GETTING DOWN TO CASES on FM broadcasting, we paid a visit to a Washington station the other day, a few weeks after it had combined its AM broadcasts with an FM set-up. It's WGAY, Silver Spring, Maryland, and claims to be the first suburban station in this area to begin FMcasting. Since WGAY didn't go on the air with even AM until last Dec. 7 (its personnel, all war veterans, haven't been too busy to forget Pearl Harbor), the station is as new as a Roosevelt dime, and twice as

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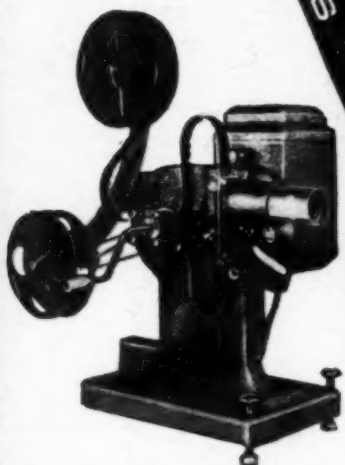
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July, 1947

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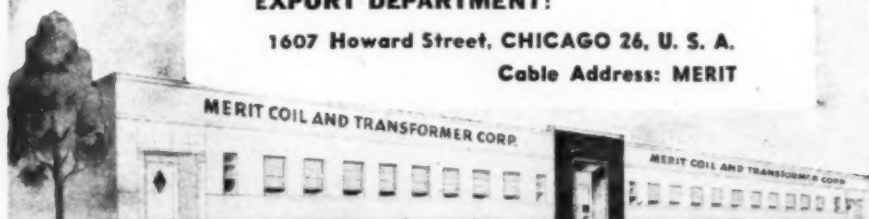


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SPOT RADIO NEWS

modern. We talked with a number of the boys, including Joseph L. (Joe) Brechner, WGAY general manager. Joe says that FM is already going well and he can prove it by a stunt the FM station pulled the day it opened in April. On AM all day it was announced that the first ten FM listeners calling the studio and giving a key word which would be broadcast over FM would get \$1.04. The figure means nothing—WGAY broadcasts on 104.3 mc. So, okay, when the key word was announced as the station went off the air—the word was “Gay,” in case you didn’t guess it—the station’s switch-board lit up like a Christmas tree.

CALLS CAME IN from all over, too—including one that amused Charles K. Chrismon, WGAY chief engineer and, at 25, one of the youngest in the field. This was from Winchester, Va., at least seventy-five miles from Silver Spring, with a 2000-foot mountain in between. A listener down there who knows his FM said that WGAY was coming in as clear as a bell and when the WGAY boys doubted it, he let them listen to the broadcast over the phone. As Joe Brechner put it, the reception at that distance meant either that WGAY’s broadcast had crawled over the mountain or was violating an established radio theory. . . . Chrismon, it turned out, was the least surprised of anybody at the station. A Navy veteran, he knew of an FM broadcast in the Washington area during the war which was picked up in Honolulu. . . . Incidentally, WGAY thinks that the Bailey estimate of 25 persons per full-time FM station is a little high, at least for the present. The total WGAY crew, including Brechner and the station president, John W. Kluge, is 18. These include three engineers, three staff announcers, three newsmen, one script writer, one woman’s director, one program director, and one janitor.

A FLOCK OF HAMS in these parts have been burgeoning the air recently with that heaviest of sports—chess. Games are played five nights a week over a local hook-up under the guidance of Washington Radio Chess Club’s control station W3KRN, run by ham Glenn Scillian, a Washingtonian. Among the stars of the league is Irvin Hershowitz, 22-year-old, of W3HQQ, and blind. Plays are made by numbering the squares on the chess board. Irv’s squares have Braille numbers. Typical of the ham spirit, two other radio amateurs—designed Hershowitz’s board so that he could get in the league. They are Maj. Alvin E. Robinson, W3LZU, of Mt. Ranier, Md., who served in the war as personal pilot for General Omar Bradley, and Ralph V. Anderson, another Washingtonian. According to our reports, Irv does all right although at times he is bothered by kibitzers giving advice on a tough move from the aerial sidelines. . . . If you are attracted to some fancy skull

RADIO NEWS



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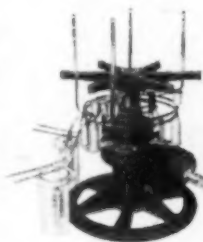
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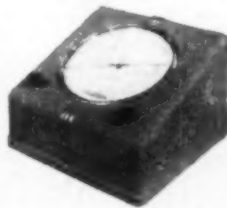
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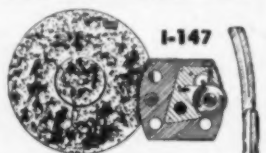
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S P O T R A D I O N E W S

practice, it might interest you to know that the club meets every night, Washington time, except Tuesdays and Thursdays, with the initial call for play going out on 29,400 kc. in the 10-meter amateur band. Paired players move to a new frequency before the games start to avoid interference. Other active members include Jack Tunis, W4KDK; Willis Campbell, W3WLM, Burt S. Engel, W3KFZ, R. J. Schneider, W3MJE, and Frank Speight, W3MNR.

RADIO CHESS is, of course, nothing new to many a ham, and international matches have not been uncommon. But the Washington group claim that they keep playing more often, consistently and with greater zest than any other league in the circuit, and their schedule would seem to bear them out. . . . They certainly have one of the world's most unusual hams in Irv Hershowitz. He's been broadcasting since 1937 and radio is both a profession and a hobby. By day he is an aircraft radio maintenance technician at Bolling Field, and served there throughout the war.

FROM TIME TO TIME (Radio News, September, 1946; May, 1947) we have mentioned that big things were going to be doing in international radio one of these days. Last year, State department sources said, the most significant meeting in world radio history would be held, probably in Washington, possibly early this year. Early this year the date was finally set—May 15; and the place—Atlantic City instead of Washington. State didn't give reasons, but knowing Washington summer weather the way we do, and learning that the conference will last probably three months, and knowing how the vacation weather is advertised at Atlantic City, you can draw your own conclusions.

WE LEARNED a number of other things that may be interesting. The Atlantic City three-month gathering is not a conference to end conferences on international allocations and allied matters. To trot out a State Department word, Atlantic City will be for protocol purposes only—a protocol being a rough draft. While the rough-draft diplomats are still conferring, another conference will begin, giving another set of statesmen from home and abroad an opportunity to see Atlantic City while they work. This will be called the Plenipotentiary Conference, a plenipotentiary being a man who can okay a treaty for his government without having the treaty later bounce like a rubber check. This gathering will last a month and hopes to get beyond the protocol stage. It will be followed "in the fall" by a High Frequency Broadcasting Conference, which (it says here) will settle all outstanding international radio questions. Could be that everything will be nailed down by the end of the year,

but on the other hand there are going to be some ducky winter sports in Canada next winter and some of the conferees may get to like Atlantic City so well that they will want to go back in 1948. . . . The U. S. allocation plan, according to experts here, is a honey, and will probably be accepted without major changes. If, we hasten to add, and/or when. . . .

DROPPED IN on the FCC the other day to see how the mobile radio hook-ups were going. They're going great guns, we were told—expanding so rapidly, indeed, that the Commission is calling additional hearings on the service for early September. Urban mobile service is more in demand than highway service, but both are booming. Only thing that is holding up expansion is lack of equipment. Even so, FCC has authorized common carrier mobile service in 58 cities in the United States, plus Honolulu. Most of the hook-ups are being made by the Bell telephone system and independent telephone companies. FCC reports that the telephone industry has been okayed for about 5600 units in the urban service, and is already committed to spend some six million dollars setting the units up. In the highway branch of the development, 79 cities propose to use it in Continental U. S., plus two in Hawaii. Some 3200 units are okayed for highway use, which, together with fixed bases, represent potential cost of another four and a half million. . . . Using the telephone service is as simple as rolling off a log where available—you simply dial or ask for the mobile service operator and she dials the call number of the vehicle you want to reach. An audible or visual signal in the automobile signals the driver, who picks up his dashboard telephone set and says, "It's your nickel—begin!" On his set is a "push-to-talk" button which permits him to switch from receiving to sending. . . .

PENDING WORLD AGREEMENT on marine frequencies, FCC is going ahead on all fronts to develop radio facilities to speed water travel and insure its safety. Recent developments have been outstanding in the radar field, where experimental work got under way last September, with FCC authorizing three bands for marine radar. U. S. Coast Guard experimenters have been coordinating government marine radar work toward improving both marine and air navigational beacons and installing them extensively, especially along dangerous strips of coastline and near big harbors. There is also an extensive program going to coordinate Navy and Coast Guard work toward improving channel and buoy detection by radar. The use of precision radar, reflectors and beacons in off-shore hydrographic surveys is being set up by several organizations. . . . In the marine department (Continued on page 108)

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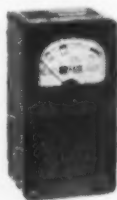
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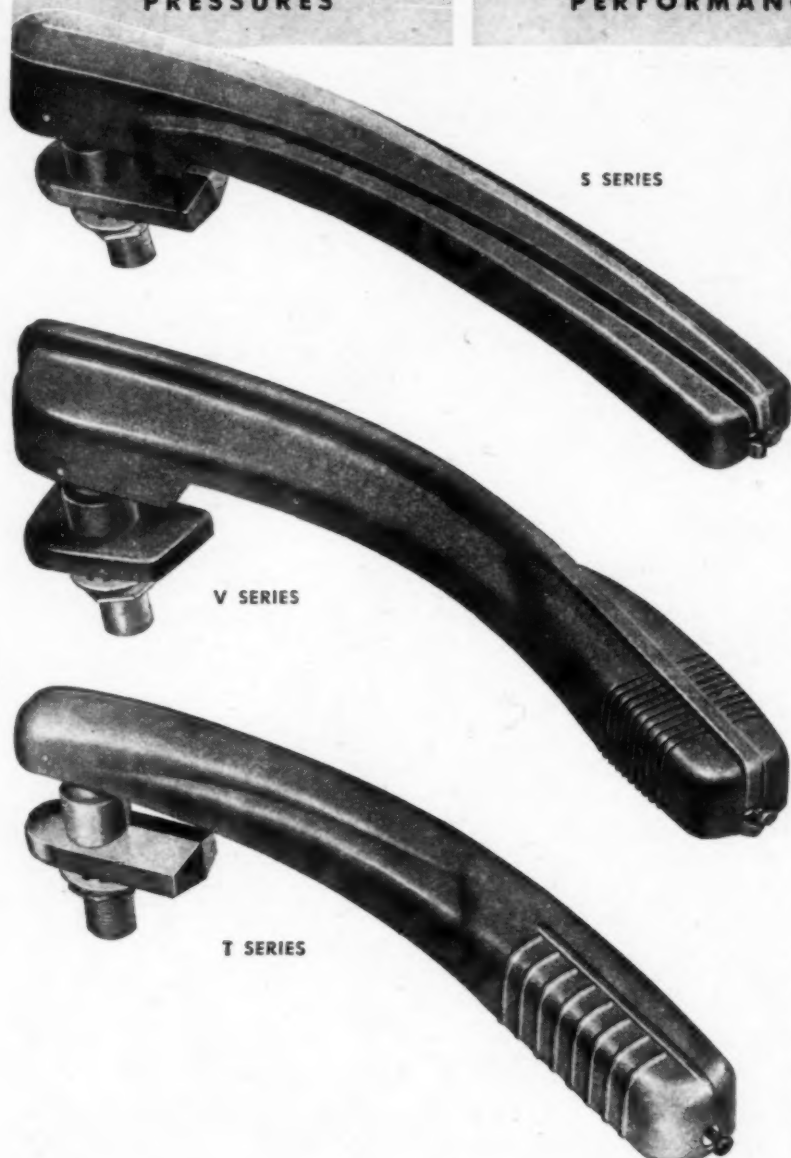
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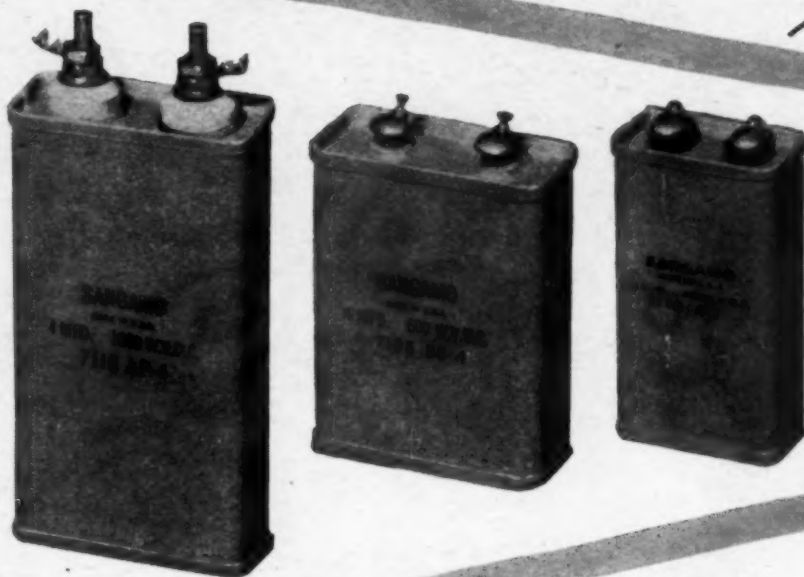
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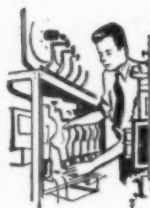
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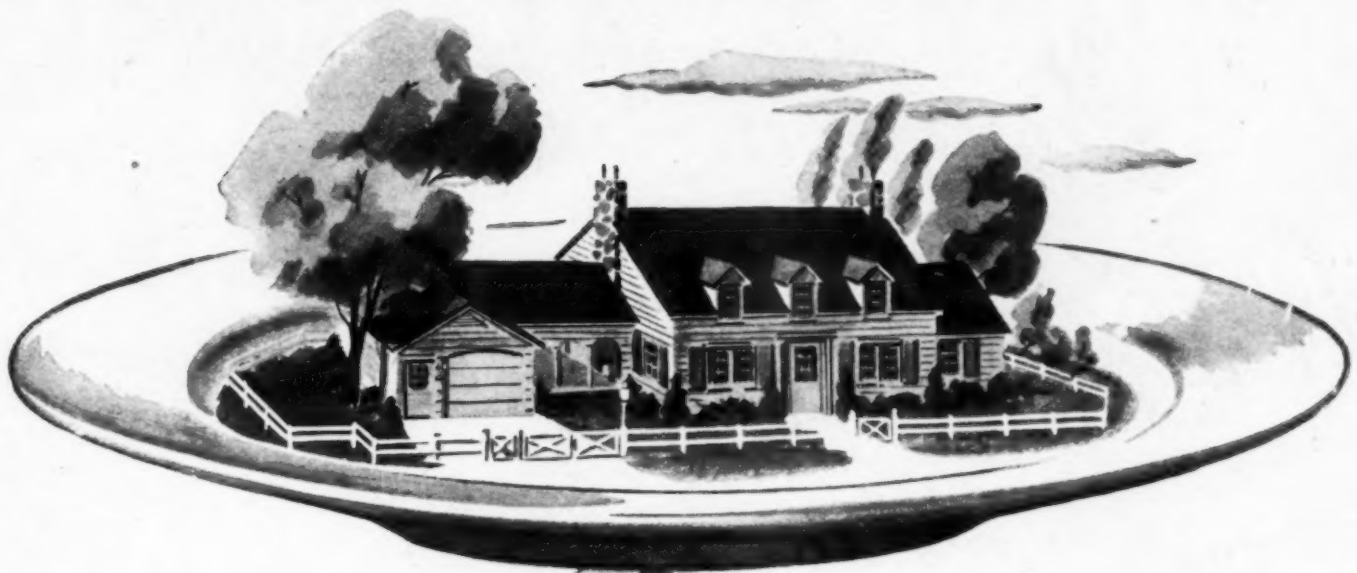
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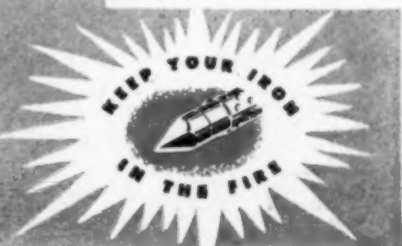
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Within the INDUSTRY

E. F. JOHNSON COMPANY of Waseca, Minnesota, has purchased from the *Gothard Manufacturing Company* of Springfield, Illinois, the *Gothard* line of indicator lights.

The line is being manufactured by the *Gothard Division of the E. F. Johnson Company* at the Waseca plant, all tools, dies, inventories and rights having been transferred to the new owner.

Current *Gothard* catalogues will remain in effect, according to the *Johnson* company.

HENRY C. L. JOHNSON has been appointed Advertising Manager of the *Rheem Manufacturing Company*.

For the past ten years, except for a short period when he served as an officer in the Navy, Mr. Johnson has been with *Sylvania Electric Products Inc.*

He was Advertising Manager of *Sylvania's* radio, electronics, and international divisions when he resigned to take his new position.

Mr. Johnson will make his headquarters at the New York office of the company.



HOWARD W. SAMS & CO., INC. are currently distributing ballots to radio servicemen asking that they indicate their preference on seven possible techniques for the schematic diagramming of tube sockets.

Working in conjunction with the RMA, ballots will be tabulated and the results will be used for the purpose of simplifying and clarifying the printing of radio and electronic diagrams.

HARRY C. INGLES, who served as Chief Signal Officer of the United States Army from July, 1943 to March, 1947, has been elected President and a Director of *RCA Institutes, Inc.*

Mr. Ingles, who retired from the Army on March 31st with the rank of Major-General, had a long and colorful career in military service. He is the holder of the Distinguished Service Medal, the Oak Leaf Cluster and decorations from Great Britain, France, Venezuela and Columbia.

He holds the degrees of Bachelor of Science and Doctor of Engineering and is a graduate of the Army Signal School and the Army War College.



The *RCA Institutes, Inc.* which he now heads has a current enrollment of 1350 students, 70 per-cent of whom are veterans of World War II.

SIDNEY KARR has been named assistant Advertising and Publicity Manager for the *Amplifier Corporation of America*.

Formerly with *Templetone Radio Mfg. Corporation* of New London as Assistant Advertising Manager, Mr. Karr conducted that company's consumer and trade advertising and public relations activities.

In his new position, Mr. Karr will undertake an educational program designed to acquaint the electronics industry with recent advances in the design and engineering of the company's amplifiers.



OLIVER J. GREENWAY was appointed Vice-President of the *International Resistance Company* at a recent meeting of the Board of Directors.

Mr. Greenway has been serving as Works Manager of the company since June of 1944 and in his new capacity joins Harry A. Ehle and Jesse Marsten as Vice-Presidents of the company.

Prior to his service with *International Resistance Company*, Mr. Greenway was associated with *Westinghouse's* East Springfield plant for 21 years.

KEITH J. ACKLEY, former chief radio and television inspector for *Stromberg-Carlson*, has joined the company's sales division as District Merchandiser covering the New England and Northeastern New York State territory.

Mr. Ackley joined the staff of *Stromberg-Carlson* immediately upon his graduation from the Syracuse University's engineering school. He was employed as a test equipment designer and was later promoted to the post of chief radio and television inspector.

He is an active amateur radio operator with the call letters W2QEO.

DON MCCLURE of *N. W. Ayer and Sons, Inc.* was elected President of the American Television Society at the annual election of officers and directors held recently in New York.

Serving with Mr. McClure are Bert



RADIO NEWS

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For home entertainment, studio, monitoring and moderately high-level sound reinforcement Jensen Model HNP-51 Coaxial has no equal at any price. Actually it is a loud speaker "system" consisting of two loud speakers and a frequency-dividing network. Frequency selector switch permits adjustment to program quality and insures correct frequency response whether operating with "FM," "AM," phonograph records or transcriptions. Cut-away section shows how precision construction and workmanship is combined with the achievement of Jensen engineering traditionally committed to the highest standards in the acoustic industry. The result creates another superlative Jensen product heading the family of Jensen Coaxial speakers ranging in price from \$30.00 to \$125.00.

All Jensen Coaxials are available in a variety of "Bass Reflex" Cabinets to make complete Reproducers. List prices of complete reproducers range from \$84.00 to \$212.00.

Ask for Data Sheet No. 136 and get complete information about Jensen Coaxial Speakers and Reproducers—all are now ready for immediate delivery. A new 24-page Jensen Catalogue also awaits your request.

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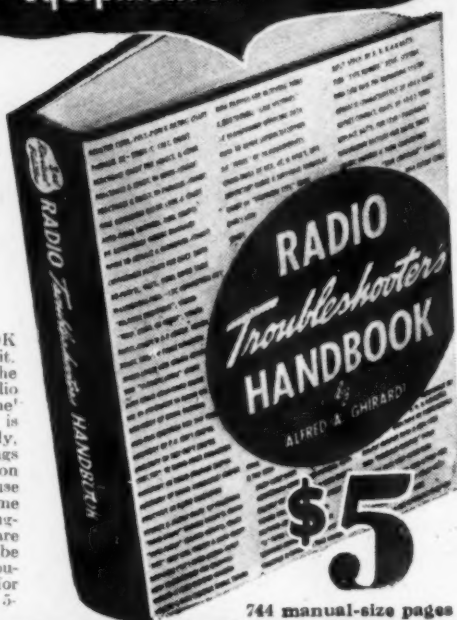
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Taylor, Jr., of DuMont Television, Vice-President; Miss Dian Dincin of Pictorial Research, Inc., Secretary; and Archibald U. Braunfeld of Braunfeld, Platto and Wolman, Auditors, Treasurer.

The board of directors include George Shupert, Charles A. Alicoate, Charles J. Durban, Jack Levine, Paul Mowrey, Edward Sobol and Edward Stasheff.

J. J. (JACK) CLUNE, has been named Merchandise Manager for Air King Radios, according to a recent announcement made by Air King Products Co., Inc., Division of Hytron Radio & Electronics Corp.



Mr. Clune is well known in the radio industry having been formerly associated with National Union Radio Corporation for seventeen years in various capacities. He directed the firm's sales during the past few years.

In his new position Mr. Clune will coordinate the company's program of merchandising and foster the closer cooperation between the manufacturer, distributors, and the company's dealers.

FRED OGILBY has been named Sales Manager of Philco Corporation's Radio Division, succeeding John M. Otter who was named General Sales Manager of the Corporation.

Mr. Ogilby joined the Philco organization in 1931 as a sales representative for the New York branch of Philco Distributors, Inc. and became Sales Manager of the agency four years later.

He served as General Manager of the Philadelphia branch of Philco from 1938 to 1945 and last year returned to New York as General Manager of that branch.

V. A. KAMIN has been appointed Merchandise Manager for the Home Radio Division of Motorola Inc. (formerly Galvin Manufacturing Corporation).



In his new position, Mr. Kamin will be responsible for the development of Motorola's home radio and television merchandise in all the various phases of engineering design, styling, and material cost.

During the war he was a lieutenant colonel in the U. S. Army Signal Corps where as chief of the Radio Branch in the Office of the Chief Signal Officer he was responsible for the engineering and development of ground signal equipment. Prior to that time, Mr. Kamin was supervisor of all radio activities for Sears Roebuck and Company.

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Output is continuously variable from less than 1 microvolt, including strays through 20 mc., to

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Add size and style matching famous "VOMAX", "SPARX" Dynamic Signal Tracer and MODEL 904 Condenser Resistor Tester and you have unmatched value. Yet volume production, carefully controlled SILVER manufacturing costs, bring you MODEL "906" at only \$89.90 net.

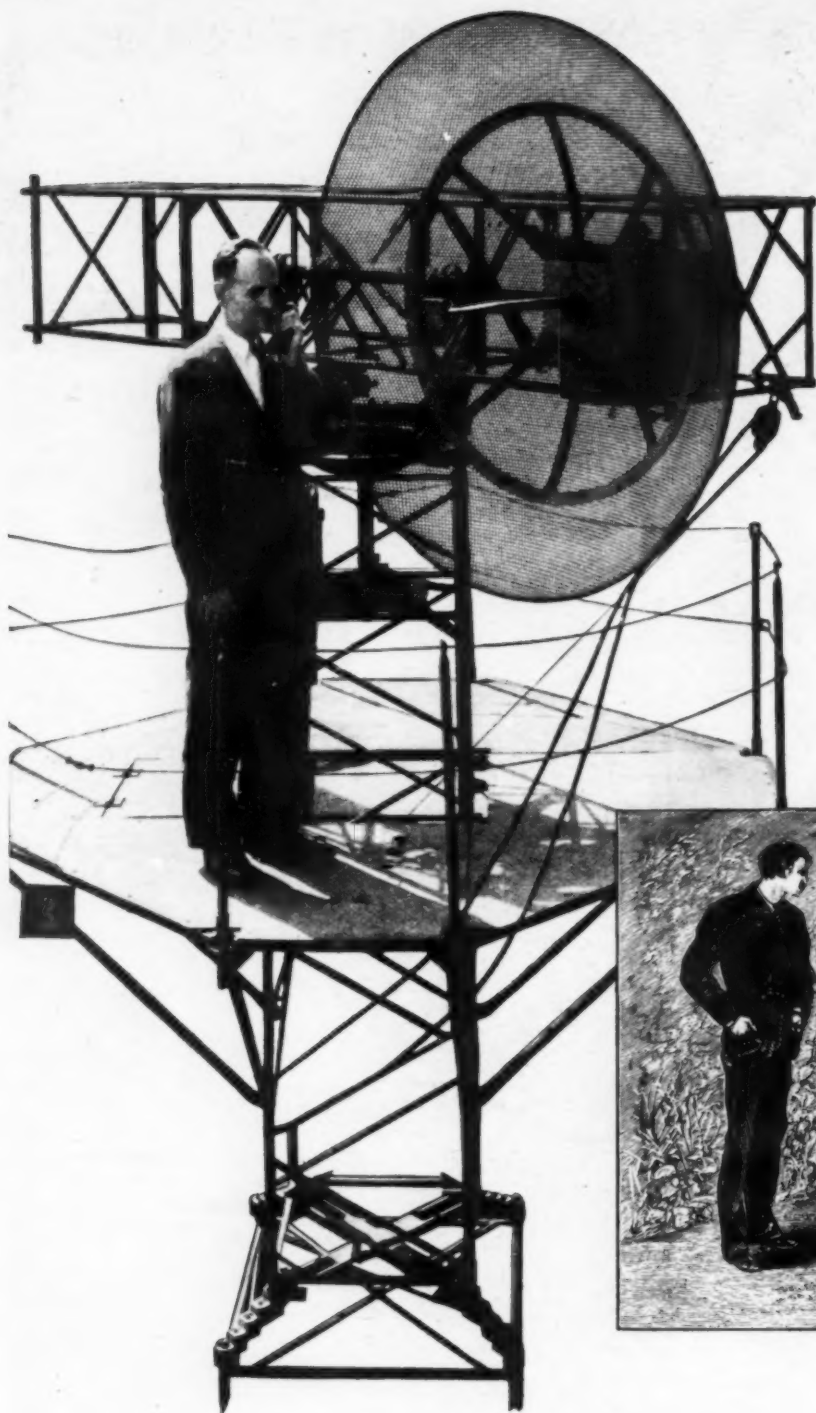
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Words that rode on a beam of light



IF Alexander Graham Bell could look at the microwave antenna in the illustration, how quickly his mind would go back to his own experiments, 67 years ago!

For in 1880 the inventor of the telephone had another new idea. Speech could be carried by electric wires, as Bell had demonstrated to the world. Could it be carried also by a *light beam*?

He got together apparatus—a telephone transmitter, a parabolic reflector, a selenium cell connected to hand-phones—and “threw” a voice across

several hundred yards by waves of visible light, electromagnetic waves of high frequency.

Bell's early experiment with the parabolic antenna and the use of light beams as carriers was for many years only a scientific novelty. His idea was far ahead of its time.

Sixty years later communication by means of a beam of radiation was achieved in a new form—beamed

microwave radio. It was developed by Bell Telephone Laboratories for military communication and found important use in the European theater. In the Bell System it is giving service between places on the mainland and nearby islands and soon such beams will be put to work in the radio relay.

In retrospect, Bell's experiment illustrates once again the inquiring spirit of the Bell System.

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Practical MICROWAVE COMMUNICATIONS



Microwave installations in mountainous locations are exposed to the elements. Perforations in the reflectors reduce wind resistance while not affecting their beaming behavior if less than a quarter wavelength in diameter. Reliable communication can be maintained despite snow and icing conditions.

By

SAMUEL FREEDMAN

Author presents details of many unusual operating characteristics which must be considered in the development of microwave communications equipment.

CURRENT and forthcoming developments in two-way radio for utilization in railway, highway, relay and personalized systems indicate that the very high frequency band will be inadequate for the number of stations involved. These services are adequately possible only if we will recognize and utilize the availability of the microwave spectrum. For immediate purposes this pertains to the frequency spectrum between 300 and 10,000 megacycles. Gradually it will be extended to the threshold of infrared or 1,000,000 megacycles.

Relatively few persons are familiar with the practical utilization of such frequencies for purely communication purposes. This limited group is comprised largely of those who were in the armed forces during World War II or who were engaged in research and the manufacture of the equipment for the armed forces. Even then, their experience may be largely based on radar or detectional applications rather than actual communication between two or more points.

The author has, for the past several years, devoted his time to extensive study and the development of two-way microwave radio equipment in what is now known as the very high frequency band as an extension of his prewar two-way radio activity for public agencies. On the basis of actual tests conducted under a wide variety of conditions, both fixed and mobile, a set of determinations have been reached at this somewhat early date which may serve as a guide to the reader in his thinking and planning with relation to microwaves.

These experiences and determinations to date may be largely summarized in the form of the following questions and answers:

1. *What will be the range or coverage?*

The minimum range and coverage under actual field tests to date indicate that it can be depended upon to reach the unobstructed horizon.

2. *Is the unobstructed horizon an absolute limit of range?*

This is usually not the case. Signals

have been received so often when the transmitting station was blocked by physical barriers such as buildings, trees, vegetation, vehicular traffic and terrain, that on ultra high frequencies at least (particularly below 500 megacycles), communication is still possible even though the signal attenuates or fluctuates markedly.

3. *What conditions facilitate communication beyond the unobstructed horizon?*

Any condition which facilitates reflections at angles and in directions as to enable the energy to proceed with sufficient intensity away from the transmitter.

4. *How bad is the maxima and minima effect?*

Between any two stations, i.e. transmitter and receiver, there will be maxima and minima effects. If one station is fixed in location, the other station will get a sine-wave signal variation between maximum and minimum or vice versa as it is moved towards or away from the other. This will occur within each half wavelength of distance. A half wavelength is 20 inches at 300 megacycles, 12 inches at 500 megacycles or 2 inches at 3000 megacycles.

5. *How is the maxima/minima effect eliminated or minimized?*

The absolute minimum signal is al-

most needle point in area. Some signal is virtually always present even if stations inadvertently locate themselves at critical distances where it might prevail. Maxima/minima effects are particularly noticeable when a vehicle moves slowly enough or the wavelength is long enough to observe sine variations in signal intensity. Extremely high signal strength will prevail at maximums and the converse at minimums with variations between these two extremes elsewhere. If the wavelength is short and the vehicle moves rapidly, persistency of human hearing is such that the signal sounds stable or sufficiently so as to provide satisfactory communication. For fixed points merely moving the equipment at either end slight amounts may make the signal vary from maximum to minimum or vice versa. Equipment should be spotted at maxima positions as indicated by strongest signal heard from a desired station. As the frequency is increased and reflectors such as parabolic or electromagnetic horn shapes are employed, then they may have an aperture which is several wavelengths in dimension. Some energy will then be obtained at all times. There will be several maxima focusing or concentrating at the antenna dipole regardless of the distance between the transmitting/receiving points.

6. *What other factors eliminate or minimize maxima/minima effects in practice?*

Unless two stations are so located

in free space with beamed transmissions too narrow to strike obstructions and reflect off, there will be signals reflecting off hillsides, buildings, vegetation, vehicles, earth's surface, etc., that will arrive by different length paths than the direct path through free space. Their maxima and minima will be different and will add to or subtract the direct energy received. It assures that some energy will always be present to provide a signal. The use of automatic volume control provisions at the receiver reduces abnormally strong signals and increases weak signals to provide a more satisfactory uniform signal level.

7. *How do ultra high frequency compare with very high frequency signals?*

U.h.f. (300 to 3000 megacycles) compares very favorably with v.h.f. (30 to 300 megacycles) within any unobstructed horizon. U.h.f. is less superior to v.h.f. or any lower frequency for ground wave communication beyond the unobstructed horizon except where physical barriers loom up on the horizon of such contour, shape and composition as to facilitate reflection of energy beyond the horizon. U.h.f. is far superior to v.h.f. when energy concentration or antenna beaming is desired and utilized because it involves physical dimensions for an array or reflector which are much more feasible to provide. For a given dimension u.h.f. may be concentrated into a radiating cone which may be a hundred times stronger than for v.h.f. This energy concentration compensates for

and even exceeds any reduction in efficiency which may exist due to losses encountered by utilizing lower frequency techniques on the higher frequencies for well designed equipment.

8. *How does super high frequency compare with ultra high frequency?*

Up to now s.h.f. (3000 to 30,000 megacycles), while proven to be possible and feasible for short range communication, has a higher rate of attenuation per mile. This attenuation increases when the atmosphere is obscured by rain, snow, dense fog or conditions other than normal visibility. Where s.h.f. has been said to have a very high rate of attenuation, investigation or inquiry will prove that this was the case when tests were made under the most adverse conditions. Such conditions might be during brief periods of the heaviest precipitation. For example, arguments made to the author have been based on tests made in the vicinity of Hawaii in a very localized and freak area of the world during brief periods of time when the heaviest rains in the world fall. Admittedly, when rain comes down in the form of a cloudburst equivalent to a solid sheet of water with little openings in the downpour, or where a blizzard brings snow down so densely that visibility is totally impossible, signals will be much weaker and be heard for much shorter distances at satisfactory signal levels.

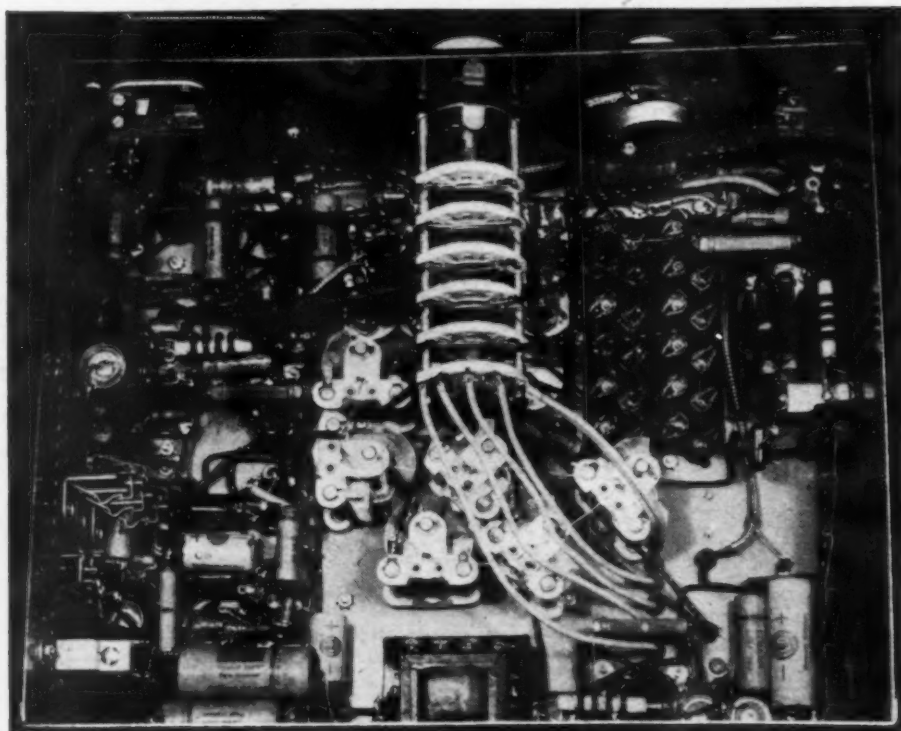
9. *What are the advantages of super high frequency?*

Among the advantages are; ease of providing highly beamed radiation with small dimensions, gains of 10,000 or more are feasible; radiation may be duplicated at the receiving point so that the over-all gain is squared; and very low power actually needs to be radiated through space. Satisfactory tests have been conducted over miles of intervening distance with actual transmitter output powers as low as a ten-thousandth part of a watt (100 microwatts). It may be highly directive to assure privacy and to make it possible to use the same frequency in the same general area for many channels of communication beamed at different angles or in different directions. A hundred kilocycles more or less means very little when the over-all frequency spectrum there is as great as 30,000,000 kilocycles. Services requiring wide channel bands such as FM or television can be readily accommodated. It is like a multi-millionaire who is able to transact normal business with only a few pennies of his total capital.

10. *What are the disadvantages of super high frequency?*

The reactance of inductance increases while the reactance of capacitance decreases with frequency at s.h.f. An inductance becomes a virtual insulator for a.c. while a condenser becomes a virtual conductor at these frequencies. This may be actually an advantage since it results in a very favorable Q or a.c.-d.c. resistance ratio. Skin effect is annoying as high frequency

An example of circuit wiring on a medium frequency operated unit which would be impractical and unnecessary for equipment operating in the microwave region. The chassis would behave like a cavity. Any wire moving even a minute distance would change the circuit operation. Each piece of wire handling high frequency energy would have higher skin effect losses and greater reactance. Most of the parts shown would be eliminated. A large portion of the capacitance required would be that already existing between the electrodes within the vacuum tube. The equipment used to illustrate a medium frequency unit is a ship-to-shore radio telephone transmitter receiver which operates at 2000 to 3000 kilocycles.



energy follows the surface instead of utilizing the entire cross-section of a conductor as in the case of d.c. or low frequencies. A conductor of large circumference may have an effective a.c. resistance that may be no better to a.c. than a conductor of small circumference is for d.c. Dielectric losses exist since the space between any two pieces of metal results in condenser effects. The reactance of a condenser becomes very low as the frequency is increased. This involves new techniques such as the use of quarter-wave phenomena which can be advantageously and conveniently used on s.h.f. while physically impractical or impossible on lower frequencies.

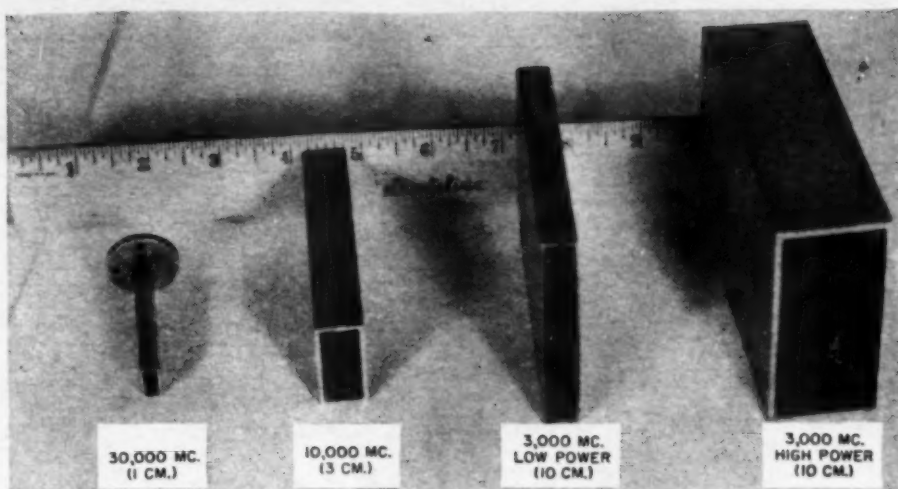
11. What can be said about frequencies higher than s.h.f.?

Super high frequencies at this time are considered to stop at 30,000 megacycles as defined by the Federal Communications Commission. What the conditions are like beyond 30,000 megacycles still is a matter for further research. Frequency regions will be found that are both favorable and unfavorable for communication. It becomes a subject of increasing interest in the field of chemistry as the various gases in the atmosphere attenuate certain ranges of frequencies. We begin to approach the infrared (or heat) spectrum from its low frequency end. Persons standing in the path of the radiation, particularly when very close to the radiator will feel a diathermy or temperature effect. Tests made by the author standing in front of an electromagnetic horn radiating 10,000 megacycles from a pulsed transmitter having about 25,000 watts peak power gave a quick temperature sensation to his body that was pleasantly warm. Our eventual goal is the light spectrum. If we can develop frequencies between 375,000,000 and 750,000,000 megacycles then the radiation through space will be the colors between red and violet.

12. When do u.h.f. and s.h.f. work phenomenal distances such as mile-ages equivalent to many horizons of range?

This may frequently take place when conditions in the atmosphere are such that the energy travels natural waveguide paths due to stratification of the atmosphere. Atmospheric stratification occurs when temperature and density layers are formed which are more pronounced than other parts of the atmosphere. Such effects may occur at almost any frequency. For example, when the author first went on the air with the initial fixed and mobile units of the Barnstable County, Massachusetts, Police two-way radio system in 1937 on a frequency of 39,900 kilocycles utilizing ten watts power at all stations, the Mission Ranch in Phoenix, Arizona, regularly recorded and advised of transmissions picked up from both fixed and mobile units on Cape Cod, 2000 miles away. Conditions were correct for duct or trapped communication. Cape Cod had fog and mist and close proximity to the ocean

July, 1947



Various sections of wave guides that can be used as transmission lines at super-high frequencies. The wider side limits the lowest frequency which can pass through, and must be more than half a wavelength in dimension. The narrower side limits the amount of power that can be handled by the guide. The wave guide can then handle a frequency higher than that represented by a half wavelength but will change its mode of operation, i.e., the point where energy may be inserted or extracted by a dipole or loop will change. The wave guide may also be used as an antenna if the end of the guide is flared out to better match the impedance of free space.

while Arizona had dry hot conditions with much desert. Radio amateurs between San Diego and Los Angeles areas in California communicate successfully on frequencies such as 144 megacycles distances of 150 miles even though this is equal to as much as 5 horizons for them. Experiences higher than that frequency although still very limited, indicate that it can be done on microwaves also. When thousands of radio amateurs take up their newly assigned frequencies in the region between 420 and 22,000 megacycles, much information will be obtained for correlation as was done when they devel-

oped short waves twenty years ago. Performances beyond the horizon will then become quite predictable. It will also become possible to associate certain weather conditions with certain radio performance. Conversely, it will be then possible to associate certain radio conditions with certain weather conditions thereby improving the forecasting of weather.

13. How can the cost of microwave equipment be kept reasonable in cost and simple in design?

This may be accomplished principally by the utilization of tubes and
(Continued on page 110)

General Electric executives inspect various types of disc seal or "lighthouse" tubes used for low powered microwave transmission and reception. Although conventional in theory of operation, interelectrode spacing is reduced to a few thousandths of an inch by bringing the plate and grid out as discs instead of through the base pins. Such tubes can maintain phase relationships between cathode and plate making possible operation up to about 4000 megacycles without requiring the transit time to exceed a period of oscillation.



A Compact 150 Watt Transmitter

By

J. B. LEDBETTER, W8YBC

Using plug-in type coils this inexpensive rig will cover the 10, 20, 40 and 80 meter bands.

THE resumption of postwar amateur activities found the author, like so many others, without adequate gear to begin operation and with very little spare time available for construction or operation. Since few new parts were to be had it was decided to rummage around in various "junk" boxes for enough parts to put a low-power c.w. rig on the air, just to satisfy the "urge" until that all-band "dream" transmitter could be built. Thus the little rig shown in Fig. 1 was born, and results have far surpassed all expectations. In fact, it has been working so smoothly that construction of the "big rig" will probably be put off a few more times.

The only parts bought new were the crystal, final tank coils and condensers, and the various bypass condensers. All the other parts, including the chassis, were either on hand or were purchased as surplus material. This accounts for the use of the 1616 rectifier tubes—they were given to the author outright and have been giving excellent service right along. At the mere 750 volts they are required to furnish it is likely they will still be here for some time to come. The 829B, purchased for \$3.00, has been in continuous operation for several months at an input of 165 watts (750 plate volts at 220 milliamperes) without showing any signs of becoming gassy. (This input greatly exceeds the manufacturer's specifications, however. According to their latest ratings, maximum plate voltage should be kept around 600, with plate current running about 200 or 210 milliamperes. These conditions are for c.w. operation and must be reduced for phone. At these inputs it is still possible to run approximately 120 to 125 watts input). Under experiment, the 829B in use at the present time has been run for one or two minutes with the key down before the plates began to show color at all (with 170 watts input). In this particular transmitter it was not found necessary to neutralize the 829B at all.

Socket connections of the 829B may

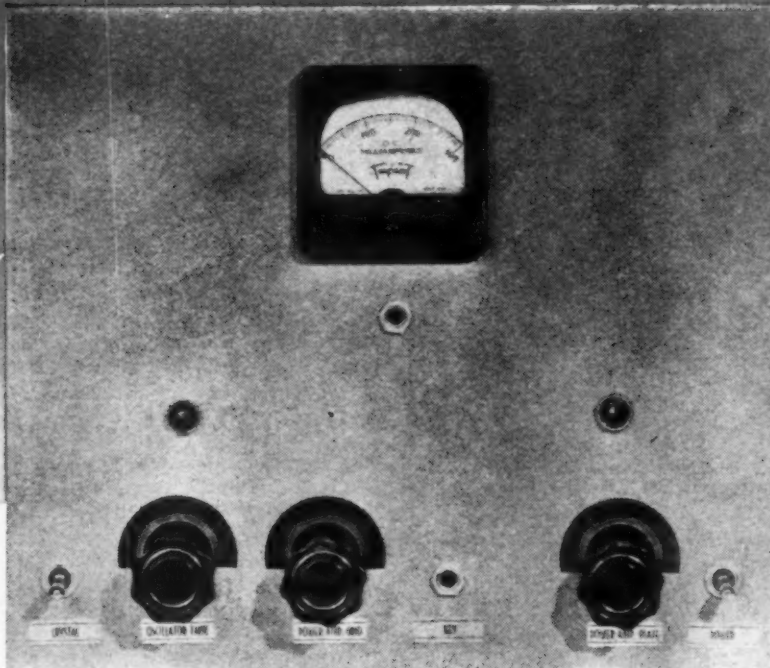


Fig. 1. Front panel view of home-built transmitter.

prove puzzling unless one has a tube manual or socket chart. Looking at the bottom of the socket, the large pin is #4. Directly across the socket (in a straight line) is the tube "index" which will be found on the tube base as a small molded "bump" or small arrow. Beginning with the first pin immediately to the left of this index "boss" and rotating in a clockwise direction, the pins are: #1 (heater), #2 (control-grid #1), #3 (screen-grid), #4 (cathodes), #5 (heater center-tap), #6 (control-grid #2), and #7 (heater). The plates, of course, are on top, #1 and #2 corresponding to the side on which the respective grids are located. For 6.3 volt operation, heater pins 1 and 7 should be tied together and connected to one side of the heater winding, with pin 5 connected to the other. In most applications it will be found permissible, and sometimes desirable, to ground one side of the heater circuit.

The shield used for the 829B is made from an aluminum can shield similar to those used for 807's or 813's and cut to size. Several large holes were drilled and reamed around the edges to allow adequate ventilation. The tank coil support was made from an odd piece of aluminum and bent as seen in the photograph. Horizontal mounting of the tank coil allows the shortest possible connecting leads to the 829B plates and at the same time affords added protection to the glass envelope.

The original panel was made from a

discarded chassis base plate, but a new masonite panel was installed later to dress up the appearance a bit. The complete transmitter is mounted on a chassis 12"x10"x3". From left to right the panel controls are: Crystal Selector Switch, Oscillator Plate Tuning, Power Amplifier Grid Tuning, Key Jack, Power Amplifier Plate Tuning, and the On-Off Power Switch. Directly above the oscillator plate control is the "On-Off" indicator lamp; above the power amplifier tank control is the "Phone-CW" indicator lamp (for future use). Under the 0-300 ma. plate meter is a closed-circuit jack for metering the power amplifier grid circuit. An external 0-50 ma. meter is plugged in when initial adjustments or changes are to be made. (Normally the grid current runs about 10 to 12 ma.). The toggle switch at the left side of the chassis (S_2) which throws the oscillator from conventional to tri-tet operation is never used unless straight-through operation is desired on the fundamental crystal frequency. It is normally left in "tri-tet" position. The oscillator second harmonic is sufficient to drive the 829B to full output on all bands.

In the top view (Fig. 3) the parts layout starts with the crystal socket, 6L6 oscillator, oscillator tank coil (with shield), final grid coil, 829B tube and shield, and the final tank coil. The rear half of the chassis is occupied by the two power supplies, with the oscillator power transformer, 80 rectifier tube and can-type filter con-

denser at the right. To the left are the 1616 rectifier tubes, two 1000 volt, 2 μ fd. filter condensers (in parallel), and the power transformer T_2 which make up the final power supply unit. This plate transformer, which is also tapped at 500 volts d.c., was purchased (used) for \$7.50. The bleeder resistor at the back of the chassis (shown without its safety cover) is another surplus item obtained for a fraction of its normal price. So far all the surplus parts used have given a good account of themselves.

Also at the back of the chassis is a 6-prong socket and plug which form the control circuit. At the present time only two prongs are being used, these going to an "On-Off" switch in the primary circuits of both power transformers. The fuse and container are located at the right rear of the chassis.

On the underside of the chassis (Fig. 4) are, left to right; crystal tank condenser, final grid tank socket and condenser, 829B socket, key jack, and the final tank condenser. In the same order at the rear of the chassis are: filter choke (oscillator power supply), control socket, filter choke (final power supply), and (on stand-off insulators) the 2.5 volt filament transformer for the 1616's.

All leads were made as short and rigid as possible in order to keep r.f. losses at a minimum. Heavy enameled bus wire was used in most circuits. Although probably not necessary, a copper shield was placed around the bottom of the 829B socket to minimize possible coupling effects between grid and plate circuits. The circuit diagram is shown in Fig. 2.

Operation and tuning of the transmitter are entirely conventional. No trouble has been experienced with drift in the oscillator or instability in

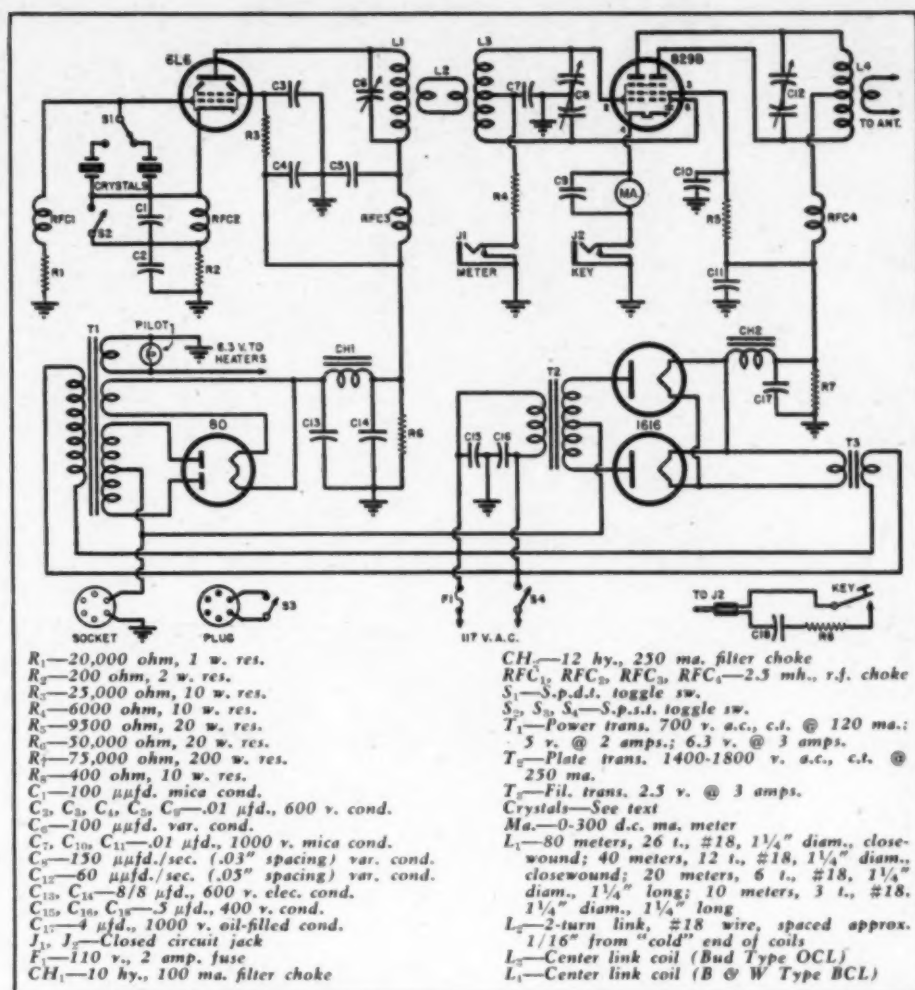


Fig. 2. Complete circuit diagram, parts list, and coil data for 150 w. transmitter.

the final stage. Slight evidence of key clicks was present until a filter circuit was installed at the key (Fig. 2).

Future plans call for construction of a modulator unit which, it is hoped,

will be capable of 50 watts audio output. An 829B will be used as Class "B" modulator, with a single 6SJ7 as speech amplifier.

(Continued on page 92)

Fig. 3. Top view of transmitter. Although components are relatively crowded, final operation is not adversely affected.

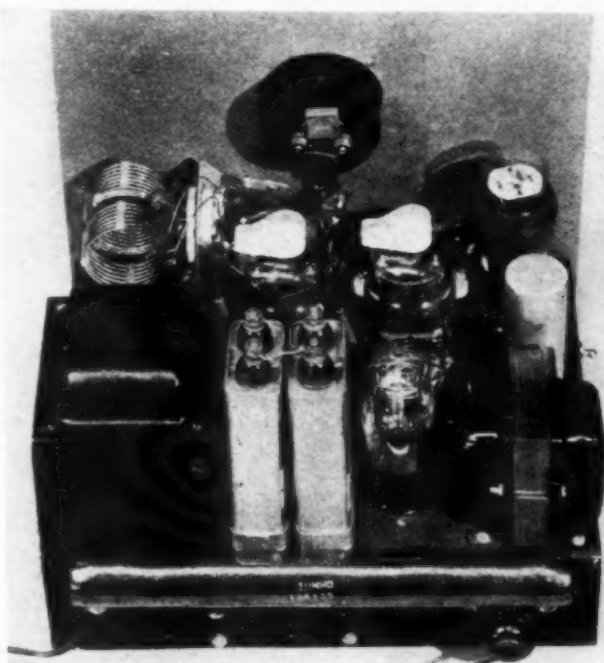
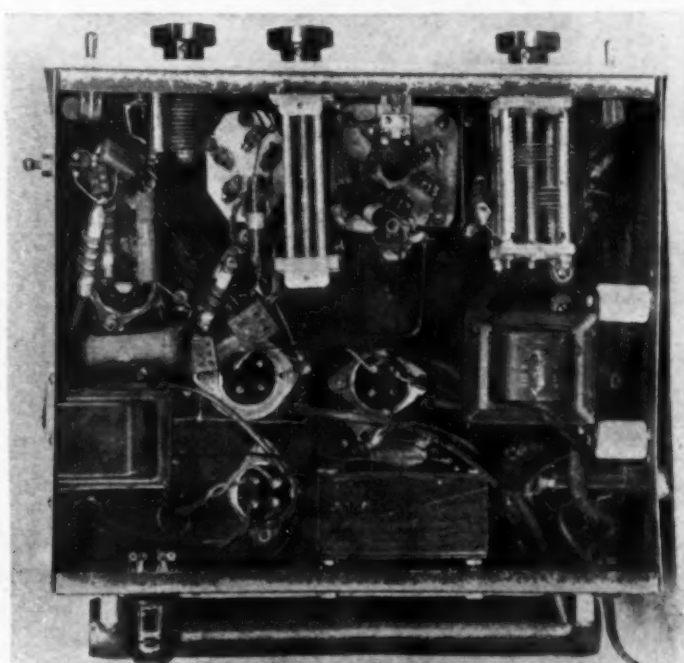


Fig. 4. Under chassis view of rig. Note that bleeder resistor is mounted externally to provide good heat dissipation.



WHAT DOES YOUR CUSTOMER BUY

By

FREDERICK J. NELSON

Adv. Dept., The Billings Gazette

**No matter what merchandise you stock, you are selling
comfort, convenience, entertainment, and/or pleasure.**

YOUR customer never buys the thing you sell! An outrageous statement! You say the stores sell nylon stockings, and the gals buy them like hot cakes. Stores sell stockings right enough, but the customers don't buy them—they buy good-looking, whistle-attracting legs.

You sell radios and radio service? Your customers buy continued hours of pleasure or knowledge which they obtain by clicking a switch on the sets you sell or service. They buy just that—pleasure or knowledge—not the radio or service.

Do you still insist that they buy the radio for itself? How many radios have you sold because the set occupied so much space in the room, or had a modernistic cabinet? Sure, the size and appearance added to the sale. However, how many of those customers would have bought if that dream set didn't first bring in the desired stations with a tone to satisfy them?

What is the answer? Just this: In selling radios or service, you must consciously or unconsciously talk in terms of what the customer wants. If you don't, you have had many a would-be customer walk out the door—with-

out one of your super, ultra, superior superheterodynes under his arm.

Of course, there was a tendency to believe that no advertising, no sales talk was necessary. To an extent, this was true. The scarcity of radios, parts and servicemen caused many people to buy the first thing they could find that was capable of bringing in the local stations. It didn't matter too much whether it was a razor blade rectifying signals from a clothesline antenna, or an upteen tube communications receiver—selling was without effort.

But! That day is over and you will now have to "sell" your services or your products.

Selling, advertising and merchandising—these terms are used almost interchangeably in modern business. All three contribute to the beautiful tone of your cash register ringing up additional sales. The truth of our topic here fits into all three of these terms.

Your customer never buys the thing you sell. Let us fit this into your selling advertising, and merchandising. Here is how. We will forget what we are selling, and we will think in terms of what the customer buys. This should be a major principle in all of

Fig. 2.

our advertising, selling and merchandising.

Newspaper Advertising

We shall compare our new principle of "Sales" first to newspaper advertising, possibly the commonest single means of advertising offered to the sales-serviceman. While we are comparing some ads against our major principle, we will add a few more important rules for good newspaper advertising.

Compare your present advertising with some of the examples we have selected.

Here is a definite "what you sell" ad:

RADIOS
PARTS
AND REPAIRS
CENTRAL RADIO SHOP
PHONE ADDRESS

Just a small ad . . . a one column by 2 inch ad appearing in the classified section every day. This expenditure for advertising is about the proper budget for local radio service advertising.

"Radios, parts and repairs" . . . is pretty much what the serviceman has to sell, isn't it? Is the ad getting results? It must be, since the advertiser continues to run it. However, any ad which tells the name and location of a shop is bound to bring in some results. We are interested in maximum results for every cent paid out or every minute of time put into sales. This particular ad leaves a lot to be desired.

This particular ad doesn't tell where the service can be obtained (in shop or at home) with only the name and address given, although the telephone implies a delivery service. A line "Pickup and Delivery Service" would definitely help this ad.

(Continued on page 116)

RADIO NEWS

A New 88-108mc. FM Tuner

By
JOHN V. URBAN, W2NBM
Development Engineer
Potter Instrument Co.

SINCE the allocation of the 88-108 mc. band to frequency modulation broadcasting, the author, like many others, has looked for a suitable tuner to use with the old audio amplifier. A system using the tuner for the old band as a variable i.f. amplifier, a 6J5 fixed oscillator, and a crystal diode mixer was tried. It was unsatisfactory, however, due to poor image rejection and lack of adequate sensitivity.

With the introduction of the new 6SB7Y pentagrid converter tube, the problem was simplified. The 6SB7Y is an octal based metal tube similar physically to the lower frequency type 6SA7 converter. However, it has slightly more than twice the conversion transconductance of the 6SA7. It also has a much higher oscillator transconductance, therefore, it is much more suitable for operation in the 100 mc. region. The frequency drift of this 11 tube tuner, using the 6SB7Y as a converter, is very satisfactory. Using one r.f. amplifier stage, employing a type 6SG7, good sensitivity and gain are realized. The antenna, r.f. and oscillator coils are all of the homemade, self-supporting, air core type, and were found to have good stability. Two i.f. amplifier stages are used, employing type 6AC7 tubes and the new, compact *Meissner* 10.7 mc. FM i.f. transformers. They are permeability tuned. A 6AC7 and a 6SJ7 are used as a cascade limiter and function very well to remove all traces of amplitude modulation. The discriminator uses a type 6H6 dual diode, whose output is coupled into $\frac{1}{2}$ of a type 6SN7GT dual triode. The other half of the 6SN7GT is used as a cathode follower output stage to provide a "stiff" output source which will be relatively unaffected by whatever it is driving. A 6U5/6G5 electron ray tube is used as a tuning indicator. The power supply uses a condenser input filter to help reduce hum to a suitably low level for high fidelity amplification. A 5Y3GT is used as the rectifier with a VR150 to stabilize the screen voltages applied to the tubes. For alignment purposes a frequency modulated signal generator and oscilloscope are recommended. While it is possible

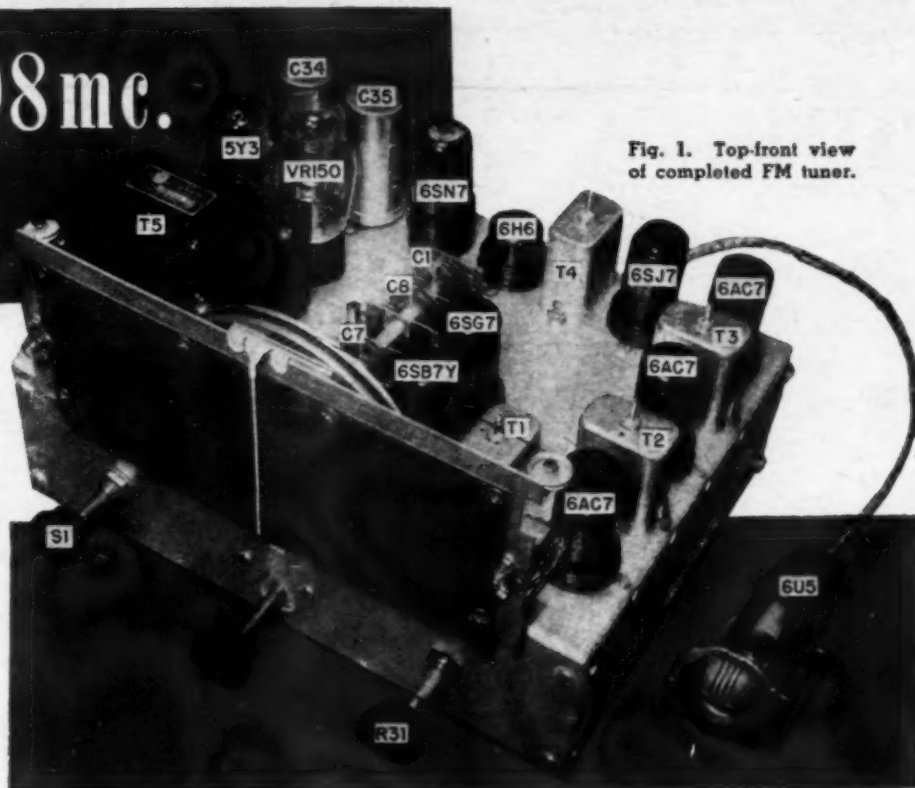


Fig. 1. Top-front view of completed FM tuner.

**Complete construction details for an FM tuner that
can be built from readily available components.**

to use an amplitude modulated signal, the process is much more tedious and the results are seldom, if ever, good. It is much more difficult to detect such faults as insufficient bandwidth due to regeneration with an AM signal. Signals of calibrated known frequencies are needed to calibrate the dial since no dials calibrated for the new FM band were available. These can be received from the broadcast stations on the air, after the tuner is completed. Fig. 1 shows the top view of the completed tuner. The 6SG7 r.f. stage is close to the center of the chassis. The circuits then proceed to the front of the chassis, around the right side and along the rear edge. This was found to be the most practical layout.

The completed chassis measures 8x11x3 inches. It is made from $\frac{3}{32}$ " thick half hard aluminum sheet. A preformed chassis may be substituted if the facilities for bending are not available. The tube layout should remain the same for short direct leads and best results. If a larger chassis is used, the relative measurements between tube sockets, i.f. transformers and other components, should remain the same. Right angle brackets are used at each corner of the chassis to increase mechanical rigidity. Due to the operating frequency of the unit, rigidity is extremely important. The aluminum was given a bright finish by dipping in caustic soda (sodium hydroxide). This must be done in a well ventilated place, outdoors if possible, and care must be exercised to safe-

guard the eyes and skin. A half of a can of "Lycon," used normally to open clogged drains, was dissolved in a suitable pan of water. The chassis was left in the solution for approximately 20 minutes and then very thoroughly rinsed. After drying, a thin clear lacquer coat is applied. This results in a permanent bright satin finish. There are many commercial concerns specializing in the application of this type of finish.

The cutout shown at the front of the chassis is for the particular *Crowe 7"* slide rule dial used and is subject to change by the builder. If plug-in electrolytics are not to be used, the two socket holes in the upper left hand corner of the chassis (Fig. 1) are not to be punched out. The tuning condenser mounting will also vary according to the type available to the builder.

Fig. 2 is a schematic diagram of the tuner. The relatively high plate and screen voltages are used to minimize the effects of electron transit time. At the higher frequencies, the time it takes for an electron to travel from the cathode to the plate becomes an appreciable part of the radio frequency oscillation time. By employing the maximum rated positive potentials, the electron has the greatest pull exerted upon it and hence tends to reach the plate as rapidly as possible.

The jumpers, bypass condensers and resistors should be wired to the sockets before they are secured to the chassis. Refer to the under chassis view, Fig. 5, for an illustration of the

All stages are adequately decoupled from the power supply to minimize instability from this source. The discriminator i.f. transformer is not actually center tapped as will be noted in the diagram. Two 100,000 ohm resistors are connected to each side of the secondary winding. The junction of these resistors is used as a center tap. This results in some loss of audio since no matter how small the current, the audio output voltage is divided between these resistors and the 100,000

ohm diode load resistors. An increase in the value of the diode load resistors results in some gain in audio output voltage. However, with the arrangement shown, the output is more than sufficient to drive any conventional amplifier having a phono channel with approximately 70 db. gain.

The antenna, radio frequency and oscillator coils are all homemade from #16 bare copper wire. The enamel can be removed from enameled wire by the use of steel wool. The antenna coil (L_a) consists of 2 turns, $\frac{5}{8}$ " in diameter. The antenna is coupled to the tuner with *Amphenol* 300 ohm twin lead transmission line and a $\frac{1}{2}$ turn link (L_1). The link is coupled to the grid end of the coil, and is also $\frac{5}{8}$ " in diameter. The r.f. coil (L_2) is 2 turns, $\frac{5}{8}$ " in diameter. The oscillator coil (L_3) is $1\frac{3}{8}$ turns $\frac{5}{8}$ " in diameter tapped at $\frac{5}{8}$ turn. All coils are approximately $\frac{1}{2}$ " long. The final adjustment on the length is made when the unit is aligned. The taps on the coils are made with a #20 wire approximately 1" long. The coils are mounted from the proper socket terminal to a suitable grounding lug on the frame of the tube socket. It is recommended that a *Cinch* socket with grounding lugs be used, since these provide short direct grounds and solid supports for the coils without the use of a lead.

After the unit is wired it should be checked for shorts and wiring mistakes and then aligned. If only an amplitude modulated signal generator is available the following data will serve as a guide to the proper procedure. Connect the signal generator to the grid of the first i.f. amplifier tube. An audio modulated signal can be used and the output of the tuner connected to an audio amplifier and speaker. Adjust the second i.f. transformer and limiter i.f. transformer for maximum audio output. The primary of the discriminator transformer tuned by the slug on the top side of the chassis is also adjusted for maximum output. The secondary of the discriminator transformer is adjusted until a definite null point of minimum audio output is found and is left at the middle of this null point. If desired, a vacuum tube voltmeter or a high resistance voltmeter of at least 20,000 ohms per volt is connected across the load resistance of one of the discriminator diodes and is used as an output meter for the adjustment of the primary winding of the discriminator transformer. The slug on the top side of the transformer is adjusted for maximum deflection of the meter. Then connect the voltmeter across the output of the discriminator (from cathode to cathode of the 6H6) and adjust the slug on the underside of the chassis for zero output indication. Apply the output of the signal generator to the grid of the mixer using a suitable blocking condenser. If the blocking condenser is not used the output of the signal generator may be greatly decreased, since, unless a blocking condenser is included in the generator, the r.f. coil will be shunted

across the output attenuator of the generator. Even with the use of a blocking condenser, the relatively low impedance of the 100 mc. tuned circuit greatly attenuates the 10.7 mc. output of the signal generator. Adjust the remaining i.f. transformer cores to maximum output and go over the complete i.f. channel and discriminator transformers, retouching any that may need to be readjusted. As a check it is a good idea to manually sweep AM signal generator a few hundred kilocycles on each side of the center frequency of 10.7 mc.

The use of a frequency modulated signal generator and oscilloscope will give much better results than the aforementioned AM alignment procedure. Connect the vertical amplifier input terminals of the scope across the 100,000 ohm load resistor in the grid return circuit of the first limiter. Apply the output of the FM generator at 10.7 mc. to the grid of the first or second i.f. tube depending upon the oscilloscope gain and the generator output available. A generator having a 750 kilocycle sweep may be used. Adjust the i.f. transformer trimmers for a maximum height image with as flat a top as possible. Refer to Fig. 4 for a typical pattern. If a calibrated variable oscillator is available it can be mixed with the FM generator signal and a marker to calibrate the bandwidth of the i.f. amplifier obtained. The i.f. channel should pass at least a total of 150 kc. across the flat top. If it doesn't, it may be due to regeneration, poor bypassing or poorly soldered joints. If all decoupling and bypassing precautions have been followed, there should

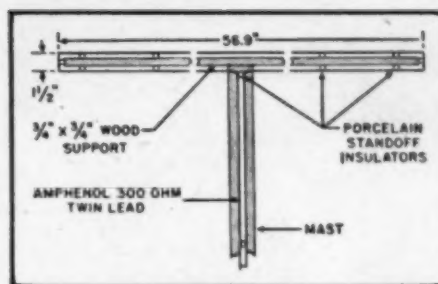


Fig. 3. Details for constructing folded dipole antenna to cover new FM band.

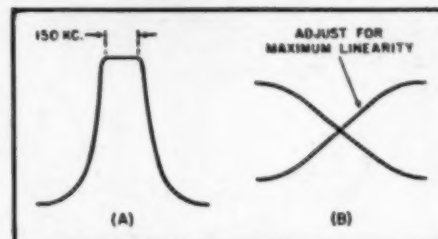
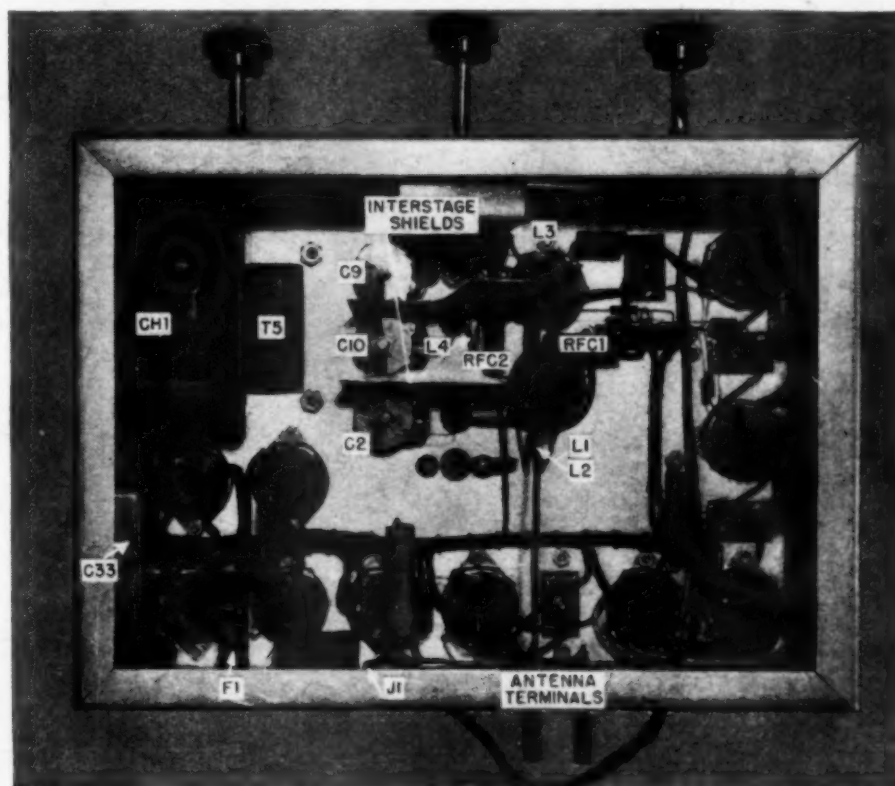


Fig. 4. (A) Typical i.f. amplifier response curve. (B) Correct discriminator pattern.

be no tendency towards regeneration. After the i.f. transformers have been aligned connect the vertical amplifier input of the oscilloscope to the output of the discriminator at the ungrounded cathode of the 6H6. At this point, a discriminator pattern resembling an X should be obtained after adjustment of the core of the transformer. The primary core of the transformer should be adjusted for maximum height of the image. The lines crossing to form the X should be made as linear as possible. See Fig. 4.

(Continued on page 118)

Fig. 5. Under chassis view of new 88-108 mc. FM tuner. Progression of circuit from 6SG7, near center, up and then clockwise around the chassis permits short, straight, rigid leads and compact component arrangement.



MODERN LIGHTING for Radio and Appliance Stores

**"Unseen" merchandise cannot be sold—Light
your store for greater product turnover.**

By H. L. LOGAN

Eng.-Consultant, Holophane Co., Inc.

THE purpose of radio-appliance stores, as of all stores, is to sell goods. This function is best exercised if all the elements of the store contribute to it. Nothing should be permitted to compete with the merchandise for the buyer's attention. Fittings, surroundings and decorations, chosen for the sake of their own beauty, and without reference to the primary purpose of the store, will inevitably compete with the merchandise and weaken its appeal.

Brightness Scale

Stating this principle positively, the merchandise should be the chief feature in the field of view of the buyer. To achieve this the light should fall on the goods *first*, and then be reflected into the traffic areas and store generally.

Scientific lighting for selling (and any other kind is a handicap) implies an ascending scale of brightness in the buyer's field of view, with the merchandise occupying the peak. Much present day store lighting still brings about the reverse condition with either the lighting equipment, or the ceiling, or the upper part of the merchandise area at the top of the brightness scale and the merchandise near the bottom.

Light sent to the ceiling first makes that structural detail the brightest feature. It is the first to attract the customer's eyes. It "optically" depresses the merchandise and may lead to an unnecessary increase in wattage for local lighting, or for accenting or modeling light, if an effort is made to counterbalance the brightness.

If general lighting is provided by means of suspended fixtures the lighting units are highest in the scale of brightness and attract attention, usurping the place of the goods in the customer's field of view. Further, this common method treats the goods as

part of the general background, lighted no more favorably than the walls, the aisles and the ceiling, with the result that even the most skillful arrangement of merchandise takes on some of the characteristics of a confusion pattern.

Controlled Direct Lighting

Controlled direct lighting, plus accent or modeling light, is the most effective method by which the merchandise can be given optical dominance. Coupled with this must go a color treatment of all surfaces—floor, walls, ceiling, fittings—designed to cooperate with the light and to fully alert the buyer physiologically.

This requires, for radio-appliance stores, a floor finish that will reflect 30% of the light, walls that will reflect about 50%, a ceiling that will reflect

80%, and fittings that will reflect about 40%. One color scheme that will meet these requirements is a medium sand colored floor, pale bluish-green walls, a medium blue-green finish for the fittings and an oyster white on the ceiling. Many other color schemes can be worked out for the above reflection factors to suit individual tastes.

Ground Light

The minimum ground light necessary to physiologically alert a buyer in a "surround" having the above reflection factors is 30 footcandles. Today this can be most conveniently secured with fluorescent lamps. The bare tubes should never be used. They are less bright than incandescent lamps but still too bright to be used uncovered with any degree of comfort. There is little sense in making a

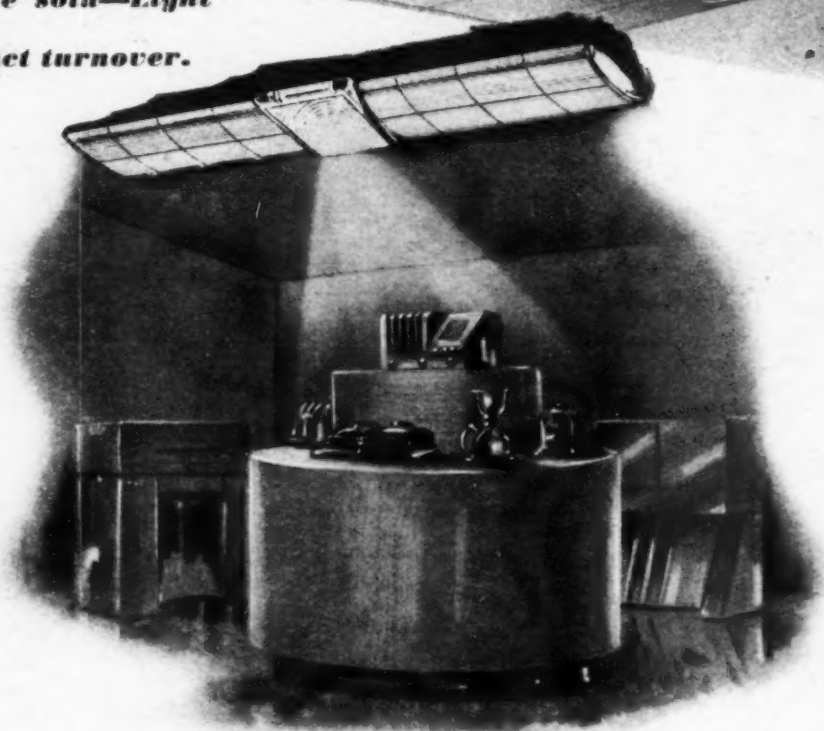


Fig. 1. (Top) Modern ceiling fixture which provides controlled ground lighting through use of fluorescent tubes and proper enclosure. (Bottom) Ceiling fixture which can be adapted for use in spotlighting merchandise displays through use of fluorescent general lighting and incandescent accent lighting in a single unit housing.

buyer uncomfortable when you are trying to get him or her to buy something, not to mention the comfort of the employees. Further, the light from the bare tubes is so thoroughly diffused as to reduce the contrast between objects and their background, thus requiring more light for a given degree of clarity than would otherwise be the case. If the tubes are used in enclosing equipment that controls the light by bending it away from its innumerable diffuse paths into paths directed towards the merchandise and the lower part of the store generally, the drop in vision caused by diffusion can be avoided.

Equipment of this general nature is shown in Fig. 1 (Top).

Accent Light

The modeling or accenting light, used on island displays, or to accentuate special features of the merchandise, should be from two to three times the intensity level of the ground light. Fig. 3 shows the relationship between the ground light and accent illumination levels as determined by checking the proportion of potential buyers that could be diverted to an accented feature by using different illumination (and hence, different brightness) levels.

The accenting light has to be incandescent, not only because fluorescent light does not enhance the appearance of objects or people, but because it cannot be focused or concentrated to the degree required for "modeling" purposes. There are many devices on the market that can be used for this purpose but sometimes it is desirable to combine the accent light with the general light for the sake of good appearance. A new combination of fluorescent "ground" lighting unit with incandescent "modeling" light is shown in Fig. 1 (Bottom).

Typical Store Plan

In planning a lighting layout for a radio and appliance store it would be well to keep several important factors in mind. The entrance into the store, aisles and general lighting areas should be illuminated by fluorescent fixtures of some type or other. The one illustrated in Fig. 1 is considered ideal for this purpose. Should the store fixtures include island displays it would be well to place these near the front of the store. These islands should have accent lights pouring high level illumination directly upon them. If a ceiling type fixture, as shown in Fig. 1 (Bottom), is used for this purpose, it will be necessary to eliminate any canopy over the island display. Displays with canopies can be lighted individually, as illustrated in Fig. 2.

The lights recommended are industrial dust-tight units having a concentrating distribution. They are entirely enclosed, can be lifted up out of the holes in the canopy in which they rest on flanges, for opening and relamping, and require practically no maintenance. This latter is a very important feature in stores.

July, 1947

Care should be taken to choose the proper lighting effects in record play back booths. They should be lighted by a built-in ceiling unit, using a 100 watt incandescent light. This is desirable to the extent that light can affect emotions—fluorescent light chills them. The use of fluorescent lights is not conducive to building up emotional listening pleasure. If two ladies sit together in a booth lighted by fluorescent lamps each of them is likely to think the other looks a little ghastly. The foundation of booth lighting should therefore be a built-in incandescent fixture that is easy to maintain.

There is a trend toward introducing mood lighting into booths and particularly television display rooms; that is, having some mobile color arrange-

inate from below in order to get onto the two walls selected and the ceiling. A possible way of doing this is shown in Fig. 4.

This method requires the standard 5 feet by 6 feet booth to be increased about 8 inches in both dimensions, although the floor will remain the same size as before, the increase occurring at the level of the top of the record reproducer. At this level the walls would be stepped back 8 inches on the two sides before mentioned, allowing space in which to place red, green, and blue incandescent lamps on about 6 inch centers, below concentrating lenses. Louvers should be placed on top of the lenses to protect the listener's eyes from strain. The listener should be further protected by the face board which should be carried above



Fig. 2. One type of direct lighting unit which may be used for island display highlighting. These units are sealed against dust and moisture. Relamping may be accomplished easily and quickly.

ment that would permit milady to adjust the color tone of the interior to heighten her enjoyment of the music, and increase her desire to possess the record, or the machine being demonstrated. Any arrangement of this sort will be relatively expensive and only experience can determine if it will put money into the pockets of the store owners through increased sales. It may, of course, become a competitive feature—a service that a store has to give because it has been adopted by competition.

It is easy to see, by a process of elimination, that the only surfaces on which color might be played advantageously are the wall that faces the sitter, the wall opposite the doorway and the ceiling. There is nothing to be gained by playing color on the wall behind the listener, and not much advantage (but a great deal of added cost and difficulty) in playing it on the entrance wall, cut up, as it is, by the door. The color would have to orig-

inate from below in order to get onto the two walls selected and the ceiling.

Each color of light should be wired separately and tied into separate rheostats or dimmer controls. The dimmer controls for each color, and for the incandescent ceiling light should be located so as to be within convenient reach.

The white light (ceiling) would be switched on to the "full" position when the listener entered the booth. From that point on the listener could dim the white light by turning the "white" knob down, and could turn on the red, blue, or green lights full or in any combination of strengths desired, by turning the "red," "green" or "blue" knobs.

The various combinations of the above three colors will produce any intermediate color, and the addition of a dimmer on the "white" ceiling light would enlarge the range of color sensations to include a wide variety of delicate tints.

(Continued on page 120)

807 makes low cost Power Packaged Modulator

By RUFUS P. TURNER, W1AY

A pair of 807's, operating class AB₂, will supply a maximum audio output of 120 watts with relatively low driving power.

THE versatility and high power sensitivity of the 807 in radio frequency circuits are well known to the transmitting amateur. In fact, it is so commonplace to think of this tube in connection with oscillators, frequency multipliers, and final amplifiers that the importance of the 807 as an economical modulator is often overlooked.

A pair of 807's operated in a class "AB₂" modulator will give a maximum audio output of 120 watts with only .2 watt driving power. (The latter figure of course does not take into consideration power losses in the driver transformer, 807 grid circuit, etc.). This is sufficient audio to plate modulate almost a quarter kilowatt final amplifier input or to cathode modulate 600 watts

input. The d.c. plate and screen voltages required by the 807's doing this job are only 750 and 300, respectively, making it possible to "package" the small power supply with the modulator itself.

Table 1 shows the RCA ICAS ratings for the 807 in class "AB₂" audio service.

Fig. 1 shows the circuit schematic of a push-pull 807 modulator and integral speech amplifier. This arrangement has sufficient gain to accommodate all amateur microphones.

The 807 power supply must be capable of delivering one of the d.c. plate voltages listed in Table 1, at not less than 280 milliamperes. This will take care of regulated screens as well. A 300-milliampere transformer should be used whenever obtainable. The filter should employ choke input, to insure good voltage regulation. The 6.3 volt filament transformer (or winding) must supply 5 amperes at good safety factor if all of the tubes are to be heated from this one source. If separate filament windings are employed, the one supplying the 807's need be rated only at 2 to 3 amperes, and the one supplying the speech amplifier tubes can be a 2 ampere job.

From Fig. 1, it will be seen that the 807 screen voltage is regulated by means of a pair of OD3/VR150 tubes. Regulation of this voltage insures maximum audio output with good voice quality.

It is desirable to provide a separate 300-volt, 50-milliampere d.c. power supply for the speech amplifier stages. Such a unit would be small-sized. However, the required 300 volts may be obtained from a tap on a voltage divider in the 807 plate power supply if this supply is able to handle the additional 50-milliampere drain.

The value of resistor R_{12} will depend upon the available 807 plate voltage. It must have a 25 to 30 watt power rating, and must be provided with a clip or slider for varying the resistance. The total resistance of R_{12} should be 20,000 ohms when the 807

(Continued on page 159)

Table 1. Chart gives RCA tube ratings for the 807 operating class AB₂.

VALUES FOR 2 TUBES				
D. C. Plate Voltage.....	400	500	600	750 volts
D. C. Screen Voltage.....	300	300	300	300 volts
D. C. Grid Voltage (Fixed).....	-25	-25	-30	-32 volts
Peak A.F. Grid-to-Grid Voltage.....	78	78	78	92 volts
Zero-Sig. D.C. Plate Current.....	100	100	60	60 ma.
Max-Sig. D.C. Plate Current.....	240	240	200	240 ma.
Zero-Sig. D.C. Screen Current.....	5	5	5	5 ma.
Max-Sig. D.C. Screen Current.....	10	10	10	10 ma.
Effective Load Resistance (Plate-to-Plate)...	3200	4240	6400	6950 ohms
Peak Grid Input Power.....	.2	.2	.1	.2 watt
Max-Sig. Power Output (Approx.).....	55	75	80	120 watts

Fig. 1. Diagram of modulator and integral speech amplifier. Circuit has sufficient gain to accommodate all types of microphones commonly used by amateurs.

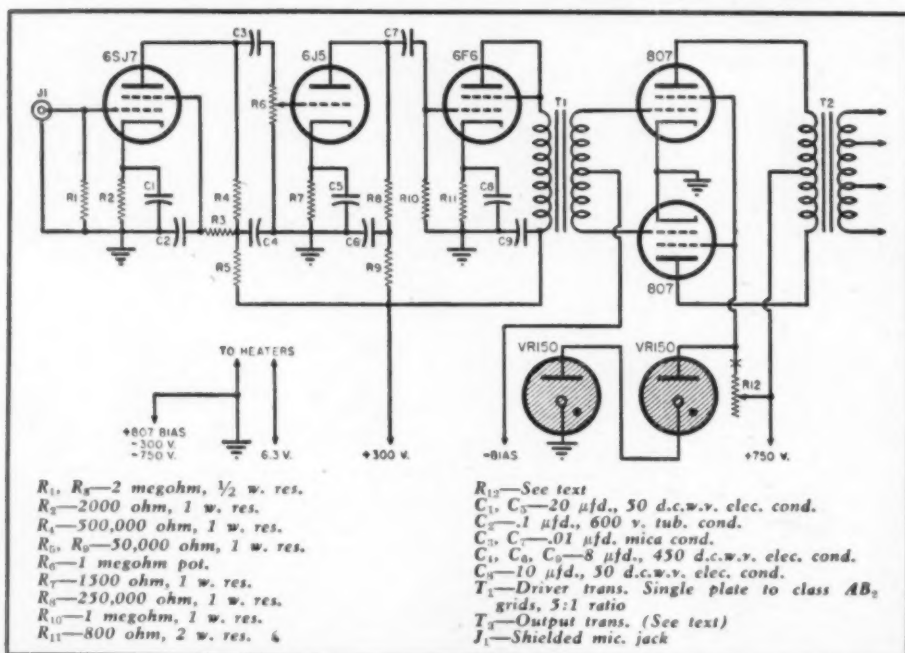




Fig. 1. Panel view of the converted Navy receiver. The S-meter is a surplus 0-1 milliammeter. The knob underneath the tuning control is for S-meter adjustment.

A 425mc. Super from Navy's ASB-7

By

L. W. MAY, JR., W3AJG

Only minor changes are necessary to convert this Navy surplus item into a triple detection type superheterodyne for amateur radio applications.

SURPLUS war material has provided many an amateur with excellent receiving and transmitting gear at a very nominal cost. Especially is this true for the v.h.f. and u.h.f. enthusiast. Since, in wartime radio research, greater strides were made in the v.h.f. and u.h.f. fields than in any other branch, perhaps—it is natural that a portion of this same equipment would find its way into the amateur v.h.f. and u.h.f. fields.

For the 144 mc. band, the world famous SCR-522 solved the problem of a very inexpensive v.h.f. superheterodyne type receiver. In the 235-240 mc. range, a very easily modified piece of inexpensive surplus, known as the Navy ARR-1 or ARR-2, provided the basis for the same type of receiving equipment.

Having thus conquered, so to speak, these two v.h.f. bands with superhet type receiving gear, the writer had been looking longingly at the 425 mc. u.h.f. band with the same "superheterodyn-ish" view in mind. Could a decent but necessarily inexpensive surplus doo-dad be found that would permit high quality u.h.f. superhet reception at these frequencies?

A device of this type would no doubt cost Uncle Sam a mere thousand bucks perhaps—but it should be able to be obtained on the surplus market for—well say 25 dollars or so—the probable cost of a homemade rush-box superregen type of receiver. Prospects were not too bright in the beginning

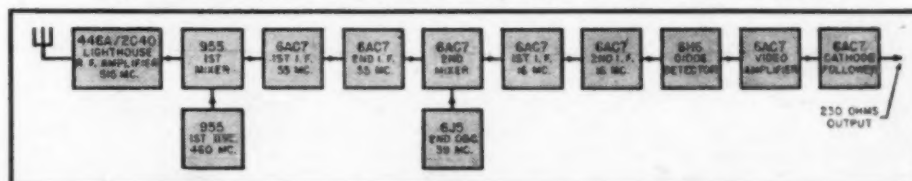
of this project, but once a ham gets than "yen," look out—

In a QSO with W4EHU, it was learned that the Navy had declared as obsolete (thereby becoming surplus) a line of radar transmitters and receivers of the ASB series. One of the receivers, the ASB-7 (CAY-46ACE) appeared to offer a perfect answer to the problem. It was a beautiful job and consisted of an r.f. stage using a 446A/2C40 lighthouse triode in connection with a precision machined coaxial tunable tank circuit, all silver plated and fitted with lead screws for adjustment. A couple of acorns (955's) served in the oscillator and mixer stages and these too used tuned lines and coax tunable tank circuits. It was a double superheterodyne type of device with the first i.f. high in frequency (55 mc.) and the second i.f. somewhat lower in frequency (16 mc.) The i.f. bandwidth was on the order of a megacycle which would be just about right. The nominal operating frequency was around 515 mc. and it appeared that quite a bit of tuning range was left to slip down at 425 mc.

At any rate, it was decided to make the try as it was just too good to pass up. It is understood that some of the later models of this receiver used lighthouse tubes in both the r.f., mixer, and oscillator stages along with coax cavities, but since the earlier model was built along more or less conventional ham lines it seemed a little better bet to "break in" on. Price? Oh yes, of course—and that is the best part. The complete unit less power supply (which is unusable anyway) sells on the surplus market for less than 25 bucks, including the lighthouse tube.

For quick reference purposes and to gain an over-all picture of the receiver before tearing into the reconversion, refer to Fig. 2 which shows a block diagram of the original system. After the r.f. section, which was described above, the signal enters the first i.f. stage at the 55 mc. difference frequency, thence is amplified again in the second i.f. 55 mc. stage. Here it is passed on to the 55 mc. converter stage and along with a 6J5 oscillator operating at 39 mc. it is transformed

Fig. 2. Block diagram of the original Navy ASB-7 receiver before conversion.



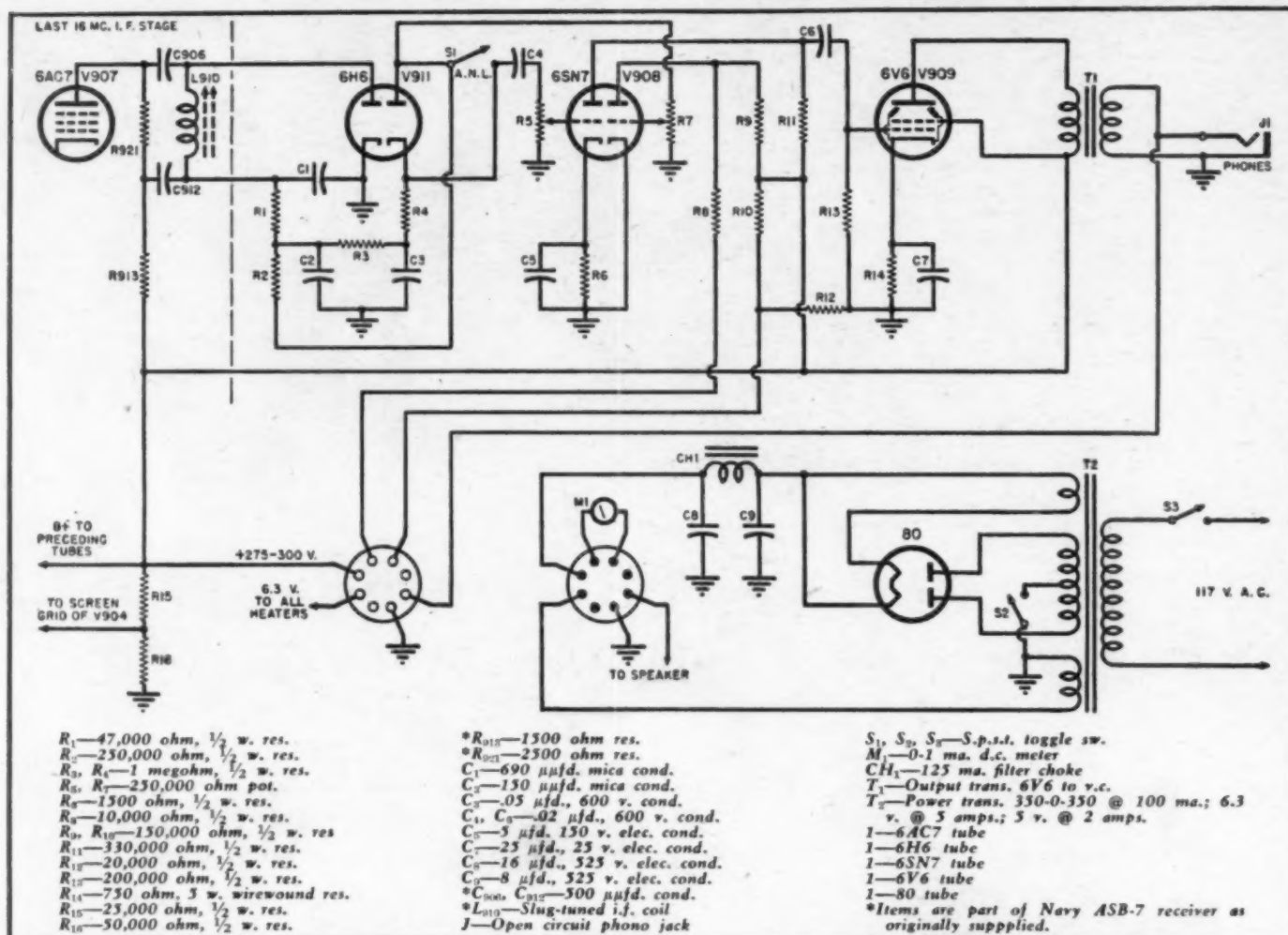


Fig. 3. Diagram of the second detector, audio, and power stages that were converted. Balance of receiver remains unchanged.

into the second i.f. frequency of 16 mc. Two i.f. stages of this frequency are employed whence it is detected in the diode 6H6 stage and fed to the video amplifier stage, which consists of a 6AC7/1852 tube. All the i.f. stages also utilize this type tube. From the video amplifier stage, the signals enter another 6AC7/1852 tube which serves as a cathode follower device with output at 230 ohms. Thus, a total of 12 tubes are employed in the complete receiver.

While it could probably be used as is, with the video and cathode follower stage, it was deemed advisable to re-convert the second detector (6H6 stage) and following amplifier stages to something more conventional. At the same time it was decided that a noise silencer and an "S" meter would be added. These features will serve mainly along with the 55 mc. and 16 mc. i.f. system as a basic i.f. channel for future converters, provision being made for entering either the 55 mc. or the 16 mc. point. (We are now looking towards the 1215 mc. superhet problem—in a very mild and relaxed manner, of course). The noise silencer incorporated is a series valve type and very effective on ignition type QRM. The "S" meter can be adjusted to read any value with a signal tuned in, thus setting your own idea of S9, and will stay on zero with no sig-

nal tuned in—which is more than some commercially produced "S" meters will do.

Briefly, the changes in the audio system were these: The original second detector stage (6H6) was modified slightly and one half of the diode was used for detection, while the other half was used as the noise silencer. The video amplifier 1852 tube was removed and in its position was substituted a 6SN7 type. This double triode tube served then in two functions. One half became the first audio amplifier tube and the other half became the "S" meter tube. Finally, the last 1852 cathode follower stage made way for the old reliable 6V6 power audio amplifier stage working into the voice coil of a small speaker. All of these modified changes are shown in Fig. 3. In the original version, the gain of the receiver was controlled externally by the voltage applied to the second i.f. screen grid element of the tube and no other control shows up on the receiver chassis itself. This has been added in the revised version and takes the form of a fixed voltage divider from the receiver power supply bus, resulting in maximum r.f. sensitivity at all times. A conventional audio gain control is incorporated into the audio section.

A standard 7 x 19 inch relay rack panel has been pressed into service

and a small speaker and suitable power supply mounted thereon, as well as the ASB-7 receiver proper. The photographs (Figs. 4 and 5) show the simple layout very clearly. With the power supply and speaker used in this manner, no other station equipment is tied up on the u.h.f. receiver and it is always ready to operate, or is readily transportable to any location where it may be advisable to conduct tests.

The front panel controls, then, are as follows: "Antenna input" (Co-ax connection), "Main Tuning" (Oscillator), "RF Tuning" (Tank circuit adjustment), "Mixer Tuning" (Tank circuit adjustment), "Audio Volume," "Phone jack" (parallel with speaker voice coil output), "A. N. L. switch," "115 v. a. c. Power Switch," "Stand-by switch" (Labeled "High Voltage Switch"), and "S" meter adjustment control.

Inside the receiver, with the case removed, adjustments may be made on the i.f. transformers, which incidentally are of high quality, fitted with powdered iron slugs adjustable from the top of the chassis. Beautiful construction and wiring is employed throughout and each stage is conspicuous by its common ground point to which all returns for that particular stage are returned and secured.

Also, within reach, inside the re-

ceiver, the coax input to the tank circuit of the lighthouse tube is easily adjustable, thus providing the correct matching of the particular antenna used. This was originally designed as a 50 ohm, non-reactive type.

Visible in the top view photo (Fig. 4), it can be seen that the heater and plate power from the power supply, as well as the speaker and "S" meter connections, enter the receiver by an octal socket which is mounted on the receiver chassis. The aluminum case fits over the whole receiver and a hole a little larger than the octal socket allows the case to slip over the socket and provides access to the power plug. In operation, this shield is necessary to block off radiation of the two heterodyne oscillators in the receiver and eliminate beats in other station equipment. This, it does quite nicely.

When all the modifications have been made in the audio system as per the modified schematic and all parts have been mounted to the front panel, the receiver is ready to be tuned to the 425 mc. u.h.f. band.

A signal generator is quite necessary here and must cover the following frequencies: First, approximately 16 mc. for alignment of the second i.f. frequency. Second, approximately 55 mc. for alignment of the first i.f. frequency, and thirdly, the expected r.f. tuning range of the band, that is, 420 mc. to 430 mc. Also in this connection, it is indispensable to have a loop absorption type wavemeter that will cover the range of from 400 to 500 mc. or so in order to double check the frequencies involved. At these ultra-high frequencies it is very easy to get off on the wrong harmonic and odd beats when dealing with a number of oscillators.

If nothing has been changed since the receiver was procured, it is very probable that the i.f. stages are already in proper alignment. However, it is a simple matter to recheck them by adjusting the screws carrying the powdered iron slugs. This procedure is entirely orthodox and will not be elaborated upon at this point. First line up the 16 mc. channel. Follow this by lining up the 55 mc. channel. The 39 mc. heterodyne oscillator working with the 55 mc. converter to produce the 16 mc. second i.f. frequency may be checked with the aid of a low frequency loop absorption meter, which is usually around the shack of any v.h.f. amateur.

Now to the r.f. end. With this end operating, check the first heterodyne oscillator (955 triode). This of course operates 55 mc. higher or lower than the signal frequency coming in. Normally it operates 55 mc. lower than the nominal 515 mc. frequency originally employed. This would then make this stage operate at 460 mc. If it is now operated 55 mc. higher in frequency than the desired incoming signal, which is 425 plus 55, this stage should be set on 480 mc. It can thus be seen that very little change will take place and it will only be necessary to

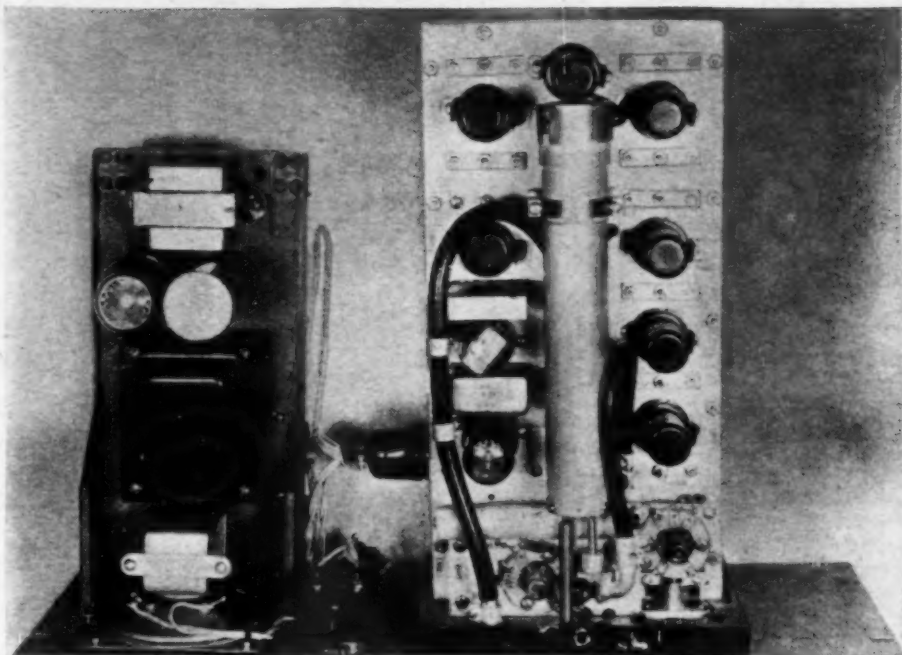


Fig. 4. Top view of the 425 mc. modified Navy ASB-7 receiver. The power supply is shown at the left with the power plug inserted into the receiver chassis. The lighthouse r.f. tube is in the end of the coax tuning line. The 955 oscillator is at the right and the 955 detector may be seen at the left of the front of the chassis.

rotate the "Main Tuning" control to raise the frequency approximately 20 mc. This "Main Tuning" control varies a circular plate and increases or decreases the distance between it and the 955 tank circuit lines. Plenty of gear reduction is available here and tuning will be found easy. Check this oscillator with the loop absorption frequency meter for a rough measurement and be sure it is approximately between 475 and 485 mc. to cover the band.

Finally, set up the r.f. signal generator to a frequency of 425 mc. and adjust the "Amplifier Tuning" and "Mixer Tuning" lead screws to maximum signal strength. In some receivers it may be necessary to shunt a very small, high quality condenser of a few micromicrofarads from the mixer grid to ground to lower the frequency sufficiently to reach 425 mc. As stated elsewhere, the antenna match may be adjusted on the lighthouse co-
(Continued on page 90)

Fig. 5. Bottom view of the receiver and power supply. The oscillator may be seen through the square cut-out at the front left hand corner of the receiver. In the bottom right hand corner of the chassis is the output transformer for the speaker. The slug-tuned 16 mc. and 55 mc. i.f. transformers may be seen lined up on the left hand side. All returns for each stage terminate at one ground lug.

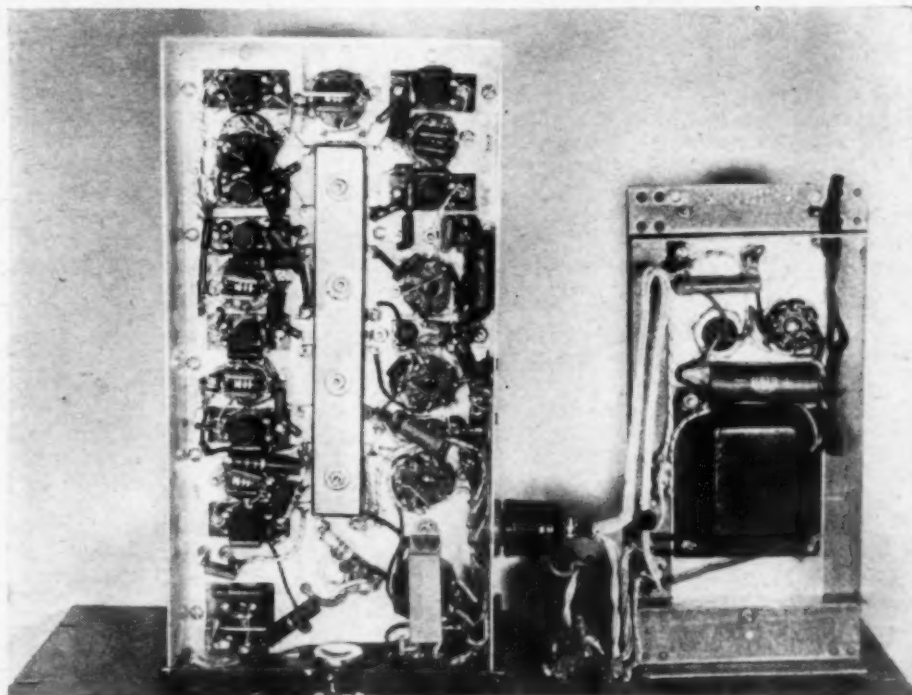


Fig. 1. Front and rear views of the completely home-built photo-timer.



By

L. A. GALLEGOS, W0SQS

An electronic photo-timer that produces split-second accuracy yet is simple to construct and easy to calibrate.

FOR ALL TYPES of photographic printing and for color work in particular, the exposure time must be accurately controlled. Accurate exposures of less than 1 second duration are difficult, if not impossible, to obtain without the aid of an automatic device such as an electronic photo-timer. The idea of using electronic means to control a photographic light is not new. Many electronic timers have been built in the past and all, without exception, have one serious disadvantage where accuracy is the prime consideration. This disadvantage comes from the use of a high resistance potentiometer as the time controlling element. The accuracy with which a high resistance potentiometer can be reset to a particular value, even with a carefully marked scale, is very poor compared with the arrangement used with the timer to be discussed here. This timer uses 11 fixed resistors for the timing circuit, and accordingly, the reset accuracy is very good. High accuracy is obtained without the use of precision resistors and capacitors by means of a novel calibration circuit. The timer produces the following time intervals:

Short range, .1 second to 1.1 second in .1 second steps.

Medium range, 1 second to 11 seconds in 1 second steps.

Long range, 5 seconds to 55 seconds in 5 second steps.

Therefore, any time interval between .1 second and 55 seconds is easily obtainable.

A timing voltage, secured by allowing a charged capacitor to discharge through a resistor, is applied to the grid of a 6SF5 tube the plate circuit of which is coupled to a 6V6 tube. A relay in the plate circuit of the 6V6 tube supplies line voltage to the photographic instrument for the period of time determined by the resistance and capacitance in the timing circuit. A complete diagram of the precision electronic timer is shown in Fig. 2.

In the capacitor charging circuit, Fig. 3A, the 6SF5 and 6V6 tubes act as two half-wave rectifier tubes connected in series, rectification taking place in the 6SF5 tube as a result of grid current flow and in the 6V6 tube as a result of screen current flow. When switch S_1 is closed, the 115-volt supply voltage is connected in series with the two half-wave rectifier tubes and the RC network, and accordingly, the capacitor C receives a charge of approximately 150 volts and of the polarity shown.

In the capacitor discharge circuit, Fig. 3B, switch S_2 starts the timing action. The instant switch S_2 is closed, the 6V6 tube conducts, closing the contacts on relay RL_1 . One pair of relay contacts completes the 115-volt a.c. circuit to the photographic instrument and the other pair of contacts is con-

nected in parallel with switch S_2 to maintain the connection across switch S_2 when the pressure is released from the push-button. The voltage across capacitor C places a high negative bias on the grid of the 6SF5 tube, and accordingly, plate current in the 6SF5 tube remains cut off for the desired period of time. When the voltage on capacitor C drops to a sufficiently low value, the 6SF5 tube conducts and a voltage drop appears across the 2 megohm plate load resistor cutting off the 6V6 plate current.

When plate current ceases to flow in the 6V6 tube, the relay contacts open, thus completing the time interval. When the relay contacts open, the capacitor C instantly takes on a new charge and the timer is ready to make another timed exposure.

For the calibration circuit of Fig. 4 potentiometer R_{11} is connected across the secondary winding of the filament transformer, T_1 , supplying a small a.c. voltage in series with the d.c. voltage provided by the discharging capacitor C in the grid-cathode circuit of the 6SF5 tube. The secondary winding of the filament transformer, T_1 , is connected so that at the instant that the a.c. voltage on the plate of the 6SF5 tube is positive with respect to its cathode, the voltage across the secondary winding drives the grid of the

6SF5 tube in a positive direction, and as a result the 6SF5 tube is "triggered" into conduction at the precise instant required. It is very important that the connections to the secondary winding be correct, for if they are reversed the 6SF5 tube cannot conduct because the 6SF5 grid voltage will swing negative as the plate voltage swings positive. The instantaneous polarities for a correctly connected transformer are indicated in Fig. 4. The timer will fail to function if the connections are incorrect, in which case all that is necessary to secure proper operation is to reverse the leads to the secondary winding of the filament transformer, T_1 .

By referring to Fig. 2 it can be seen that eleven 470,000 ohm resistors are switched into the timing circuit by the "Time Selector" switch S_1 , to provide the 11 time intervals for the three ranges. When the "Multiplying Factor" switch S_2 is set for the low range it connects a .05 μ fd. capacitor in the circuit, and when set for the medium range it connects a .5 μ fd. capacitor in the circuit, and when set for the long range it connects the .5 μ fd. and a 2 μ fd. capacitor in parallel in the timing circuit. When the "Manual-Automatic" switch S_3 is set to Manual the automatic feature of the timer is made inoperative. One pole of switch S_3 opens the cathode circuit to the 6SF5 tube and at the same time removes the charge from the timing capacitors. The other pole of switch S_3 supplies plate and screen voltage to 6V6 tube, and accordingly, relay RL_1 remains closed as long as switch S_3 is in the "Manual" position.

Calculating the RC Values

The circuit of Fig. 2 can be used to produce any desired time intervals between .1 second and 11 minutes depending on the values of resistance and capacitance in the timing circuit. The correct values for any time interval can be calculated from the relationship (1) $t = 4.32 RC$ where t is in seconds, R and C are in ohms and farads respectively. A typical example follows: Supposing it is desired to cover the range of 2 seconds to 22 seconds in 2 second intervals. Setting t equal to 2 seconds in equation (1) $RC = .463$, obviously, there are an infinite number of combinations of R and C which will yield the product .463, therefore we choose a value for C which is easily obtainable in standard capacitor sizes and solve for R . Let $C = 2 \mu$ fd. thus

$$R = \frac{.463}{2 \times 10^{-6}}$$

or 231,500 ohms approximately. Here again we must compromise on a value for R which is easily obtainable. Either a 220,000 ohm or a 250,000 ohm resistor will prove quite satisfactory. Actually the value for R is not critical because the calibration control will compensate for a wide variation in resistance values. Equation (1) is

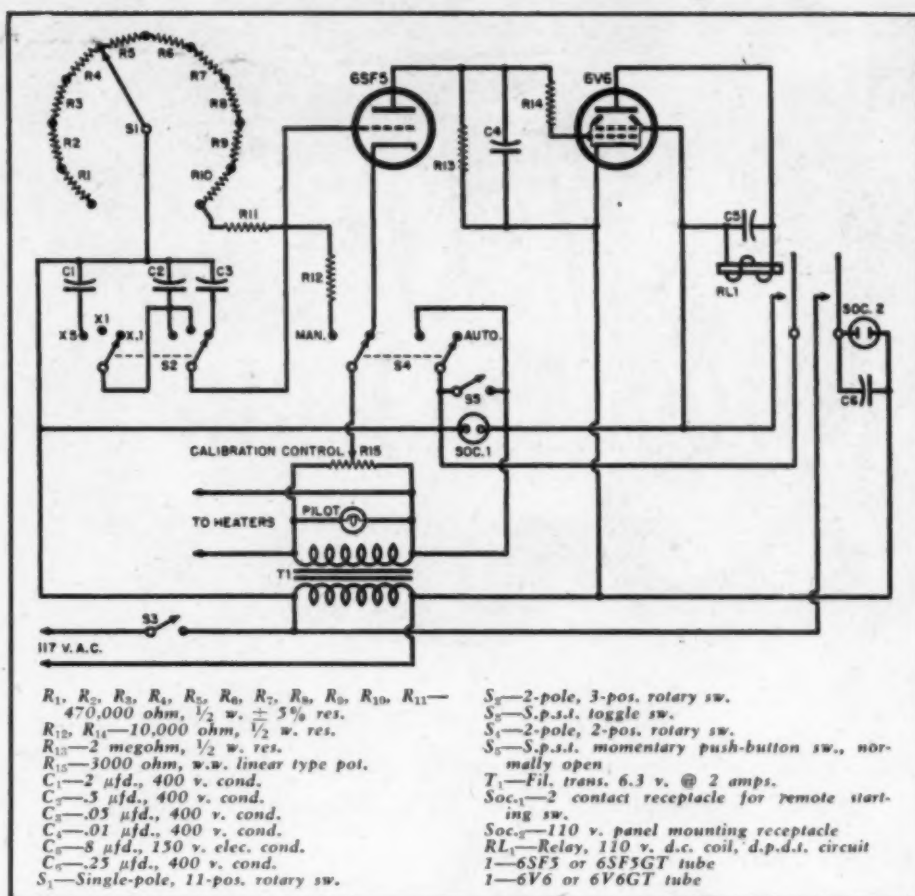


Fig. 2. Complete schematic diagram of precision electronic photo-timer.

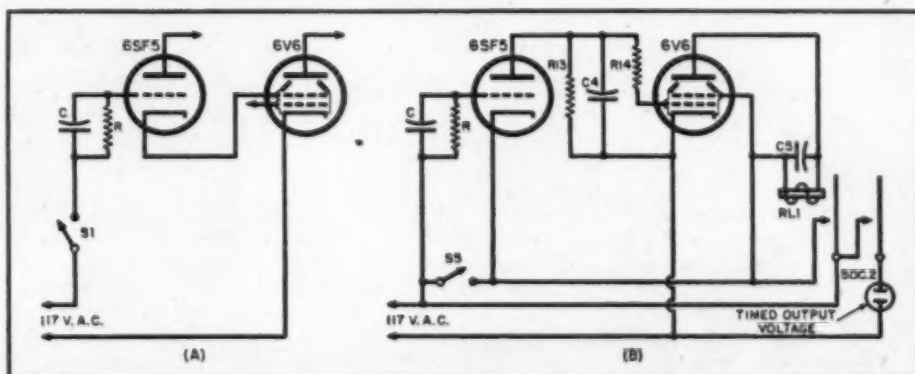
based on the calibration control set at its midpoint.

Since a 250,000 ohm resistor and a 2 μ fd. capacitor will produce a 2 second interval, we have only to add 10 additional resistors in series by means of a tap switch to provide the 11 time intervals between 2 seconds and 22 seconds. The values suggested above are by no means the only values for R and C which will produce a 2 second interval. A 1 μ fd. capacitor and a 470,000 ohm resistor would also work just as well. Because the time is directly proportional to the product RC , the range of 2 seconds to 22 seconds can be multiplied by any convenient factor by switching in additional capacitors whose values are an integral multiple of the value for the shortest range.

The front panel and subpanel can

be made from a single 8 inch by 10 inch metal panel by cutting the panel in two pieces, each 5 by 8 inches. One piece is used for the front panel and the other piece can be used for the subpanel by making a right angle bend along one of the 8 inch sides to form a $1\frac{1}{2}$ inch lip. Two strips $\frac{1}{2}$ inch wide must be cut from each end of the subpanel to allow the subpanel to clear the flanges on the front of the cabinet. These strips can be bent and used as brackets with which to secure the subpanel to the front panel. A space $1\frac{1}{2}$ inches is left between the front edge of the subpanel and the front panel to provide clearance for the switches mounted on the front panel. The metal cabinet, which can be made at any tin shop, has a $\frac{3}{8}$ inch flange turned in on all four sides of (Continued on page 156)

Fig. 3. Diagram of the capacitor charging circuit (A), and the discharging circuit (B).



A LOCAL CONTACT RIG

By
R. L. PARMENTER, W1JXF

*Two versions of a 5-watt, single-tube ham rig
that is ideally suited for 80 meter c.w. use.*

FOR MANY of the 100,000 or so licensed amateur operators on the crowded ham bands these days, it is indeed fortunate that the Federal Communications Commission is like a benevolent uncle who views our misdeeds with a tolerant eye. As long as we behave ourselves and stay within our band limits we can get away with a good deal of murder. By the sound of some of the signals on the lower frequency bands, we are doing just that. Along with many other hams (and this doesn't mean just oldtimers), we think that it is time to clean up our bands if only for the purpose of enabling more operators to get more enjoyment from their hobby.

A careful scanning of, for instance, the 80 meter c.w. band on a weekday evening will reveal many conditions

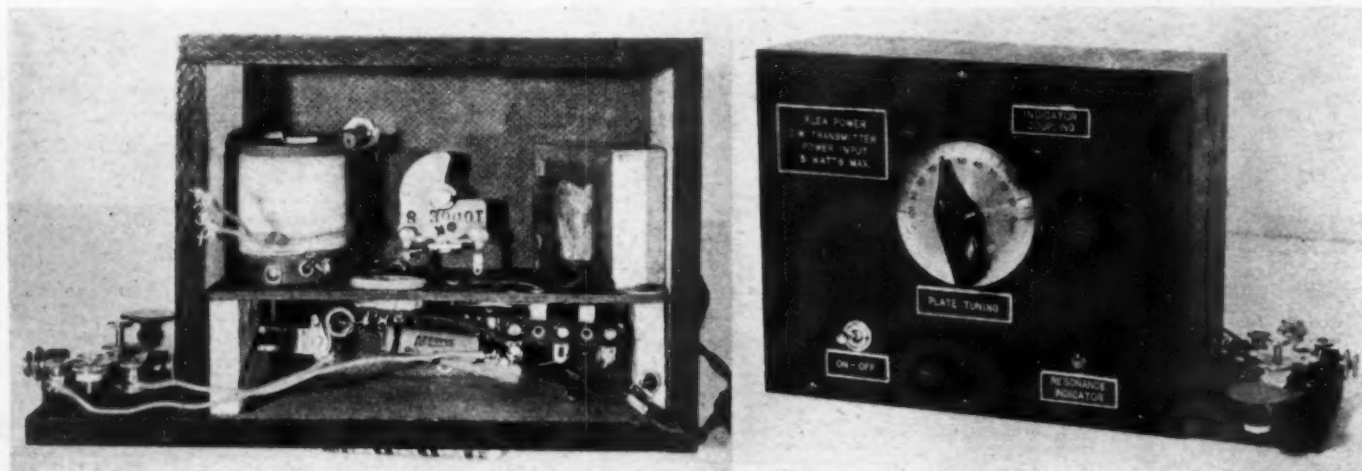
which could be improved. There are plenty of signals which could only rate a T6 or T7 if honest reports were given and there are also many chirps that are never reported. Similarly, what about the "lid" who consistently sends five dots for an H and 4's for V's. Probably these above mentioned faults will become ironed out in time, especially if the operators committing them are newcomers to the air. However, we have a "beef" that we think is justified and furthermore it is a situation that may be alleviated at least with not too much effort on the part of the offender. It will do much to make for more usable frequencies on our already crowded bands. This applies to the station that uses 200 watts or more for local contacts. How many times have you heard a swell, 599x signal pound in with key clicks

and thumps a-plenty and have said to yourself, "Boy, that sure is a local." He was, very likely. We have done this a few times and listened in to find out how much power was being used and then checked the locations of the two stations. Only too often that same QSO could have been maintained with 25 to 50 watts input instead of the 200 to 500 that was probably used.

Legally, of course, using an excess of power is outside the pale. The Communications Act, Section 324 provides, "In all circumstances, except in case of radio-communications or signals relating to vessels in distress, all radio stations . . . shall use the minimum amount of power necessary to carry out the communications desired." Penalties are provided for violation of the above in Sections 501 and 502. These, of course, apply to amateur services. There is no doubt in any of our minds that the above could be pretty well enforced if the FCC saw fit. They are tolerant, fortunately. This article is a plea for better cooperation in the use of our power capabilities. Reduce power when you are going on the air for that local ragchew. Use a variac or autotransformer in the primary of your plate supply or cut out the final and let the buffer stage take over, perhaps using a portable link to couple to the antenna. Better still, why not have a small rig just for the band that the local gang has their round-table QSOs on.

With the aforementioned concepts in mind regarding the use of our crowded frequencies we decided to try to do something about it. Accordingly, we built up the small transmitters described. From an operational viewpoint and within their limits they have been very successful. From our home location in eastern Massachusetts we have worked into Connecticut and up to Maine with fairly good reports. The antenna was just a length of wire, end-fed, and would not load well. We have used the rigs for the Sunday morning round table and reports were S9 all around. Furthermore the key-click reports were much

Fig. 1. Two views of the home-constructed low powered rig. This unit features a low cost pilot-lamp type resonance indicator.



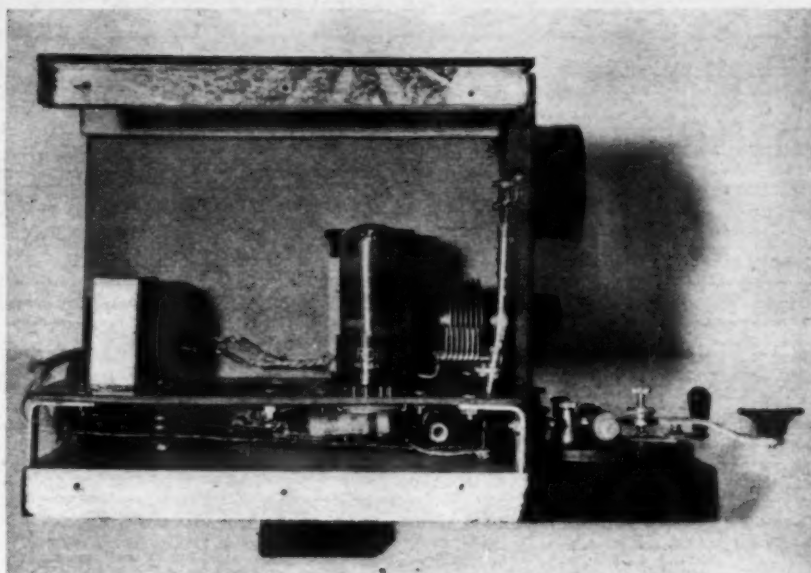


Fig. 2. With the exception of the resonance indicator, the unit shown above is identical to the rig shown in Fig. 1. A 0-100 ma. d.c. meter is used to indicate resonance in lieu of the pilot-lamp type indicator. Schematic diagram is shown in Fig. 3.

better than when using 100 watts input. This was when the rigs were just as described, using no key-click filter as is recommended. Interference was thus reduced by a sharp reduction in power. Power input was only 4.7 watts!

These rigs were intended for use only on 80 meter c.w. The only data given is for that band. They could be just as well used on some other frequencies by choice of proper values of inductance and capacity in the tuned circuits. If judicious use is made of proper operating time and the skip effect, excellent results should be had with this flea power. Boy, is the fellow on the other end surprised when you tell him that you are using 5 watts input to a 50L6!

The author thinks that when it comes to the use of power on the ham bands there is a great deal to be said. All of us in the ham fraternity realize that it is only too easy to become the victim of commercialized interests when it comes to buying more power. The United States hams have more money to spend on their hobby than probably those of any other country. Also, thanks to the manufacturers, we are able to purchase power more economically than others. For this we are duly grateful. At the same time we should not forget one of the results of this happy state of affairs. It is much easier for us to clutter up the bands. When the foreign stations are coming through there are usually so many W's calling that the foreigner cannot pull us apart. The other point that I would like to bring out is the fact that power increases do not result in better signal reports in direct proportion to the amount of money invested. On the other hand, when you reduce power, signal reports will usually stand up much better than you anticipate. This all boils down to the fact that to

raise your signal just *one* db. at the receiving end, requires an increase in power of approximately 26%. Or to put it another way, if you triple your power you are only going to raise the "S" meter on the other end 0.8 of an S-unit. This is assuming of course, that other conditions remain the same.¹ If you are contemplating raising your power from 100 watts to 300, does it still seem worthwhile?

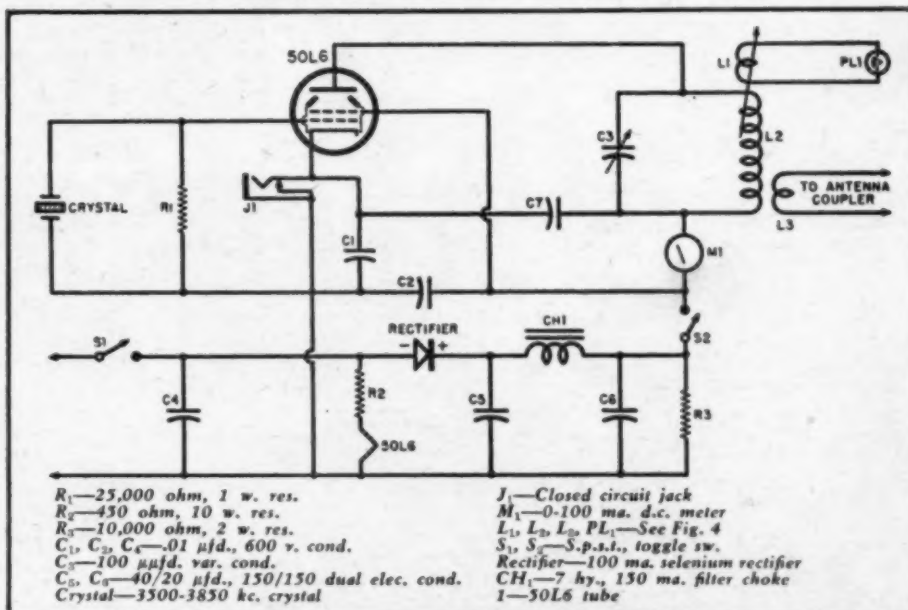
There are limits to which we can drop and still have effective results and maintain 100% QSO's. I do not say that the flea-power transmitters described herein will work out as satisfactorily as a 100 watt job will. I do maintain that there could be a great deal more discretion used when it comes to putting a lot more power on our already crowded bands.

The circuit used for both transmitters is the same, being a straight-

forward grid-plate type with some of the extras that go with high power being eliminated. They differ in the minor detail of the type of tuning indicator used. In one an inexpensive milliammeter was used for tuning up purposes and in the other a pickup loop connected to a pilot lamp was employed for the same purpose. The meter provides for better accuracy in tuning and is to be preferred. When using the alternative type with the lamp indicator it is very helpful to have a temporary meter in the plate circuit although this may be removed after adjustments have been made. Both types use a minimum of parts and the cost should be very nominal even if all components have to be purchased new. Many of the parts should be found in the average junk-box.

(Continued on page 159)

Fig. 3. Schematic diagram of low power rig. If meter type resonance indicator is used assembly L₁, PL₁ can be omitted. Power input required is only 5 watts.



¹"Power Increases and their Effect." QST, Jan. 1947.

High Voltage R.F. Power Supply

By
JOHN F. PRICE

THE high-voltage problem has slowed down many a serviceman and experimenter in his development of devices using cathode-ray tubes, such as the cathode-ray oscilloscope and television receivers. The design usually calls for a high voltage transformer and rectifier with good circuit insulation. This high voltage equipment is expensive and dangerous, and contact with voltages of the magnitudes used in these circuits is often fatal.

There has been developed in recent years a safe, economical and compact rectifier for circuits such as those mentioned above. This power unit yields the necessary high voltage but contact with this voltage is not harmful for reasons to be discussed subsequently. The principle used in this power supply is to generate high frequency, high amplitude voltage by means of an r.f. oscillator. The oscillator has its power supplied from low d.c. voltage while the high d.c. voltage is obtained by rectifying the r.f. output of the oscillator. The fre-

Analysis of an r.f. power supply, capable of producing a 1 to 50 kv.d.c. output, which is particularly applicable to cathode-ray tubes.

quency of the r.f. voltage is usually made a few hundred kilocycles in order that high circuit "Q" can be realized. The filter system is thus simplified as the resulting ripple frequency is so very high that it is easily removed. Circuits of this design have yielded from 1-50 kilovolts with very low ripple content and their use as the power units for television picture tubes have been found quite satisfactory. This power unit has proven popular with manufacturers because of the saving in space and cost which results. In addition, manufacturers have found that the inclusion of this circuit facilitates the meeting of *Underwriters'* standards with regards to insulation and safety.

A suggested design is shown in the circuit diagram "tailored" to the need of most of the readers. This design was developed by RCA and appears

in their bulletins on certain cathode-ray tubes. It uses standard parts and is not difficult to put in operation.

Referring to the diagram, the h.f. oscillator is a 6V6 tube using the well-known tickler feedback. The plate coil of the oscillator and the tickler make up the primary while the secondary is closely coupled to the primary. There are more turns of wire on the secondary than on the primary thus realizing more voltage for the rectifier. Note the rectifier is placed in the lower or ground side of the coil, eliminating the necessity for high insulation in the filament transformer.

The high voltage can be controlled by varying the tuning condenser C_3 . The condenser is adjusted to give maximum voltage and then the voltage is decreased by turning the condenser to the low capacity side of the high voltage point, the operation of the oscillator being more stable when voltage changes are made in this manner.

The extremely high voltages obtained from this circuit are due to the very high circuit Q in both the primary and secondary coils. It is clear then that when a person comes in contact with the high voltage he loads the circuit and lowers the Q thus immediately dropping the voltage to a very low value.

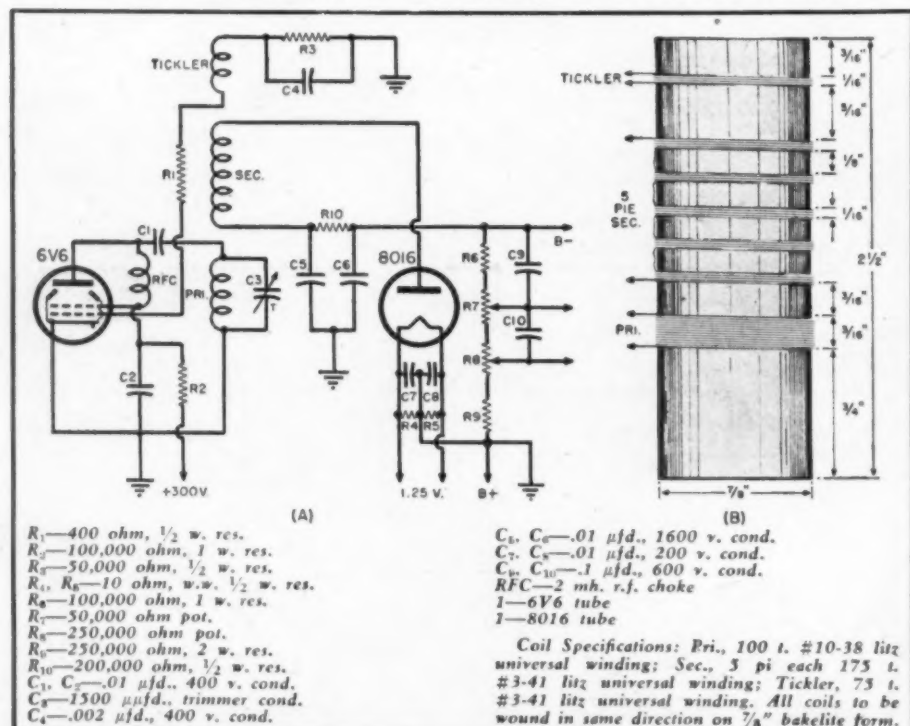
The voltage really drops almost immediately for there is some charge stored in the filter condensers, C_5 and C_6 . This charge is very small however due to the low capacity (0.01 microfarad). The reason for the small capacity filter condenser is the ripple voltage varies at the r.f. rate (around 300 kilocycles) and the RC filter consisting of the 0.2 megohm resistor and the 0.01 microfarad condensers is adequate to remove this ripple.

The low voltage d.c. is in the same order of magnitude as that used in circuits involving these cathode-ray tubes, hence no additional power supply is required providing the original power supply can deliver the necessary current and voltage increase.

The efficiency of these power units is in the neighborhood of 50% over-all.

(Continued on page 88)

Circuit diagram and complete coil specifications for building the r.f. power supply.



The RECORDING and REPRODUCTION of SOUND

By OLIVER READ

Editor, RADIO NEWS

Part 5. The crystal cutter; its construction, capabilities, and applications for "constant amplitude" and "constant velocity" recording.

IN ORDER to fully understand the capabilities of the crystal type cutter, it is well to first understand the difference between "constant amplitude" and "constant velocity" recording. The magnetic cutters previously described are essentially constant velocity devices. Crystal cutters, on the other hand, may be adapted for either constant amplitude recording or constant velocity recording. There are certain advantages to each method as will be explained.

One of the most serious limitations today to good quality reproduction from disc records is surface noise, also referred to as needle scratch. This not

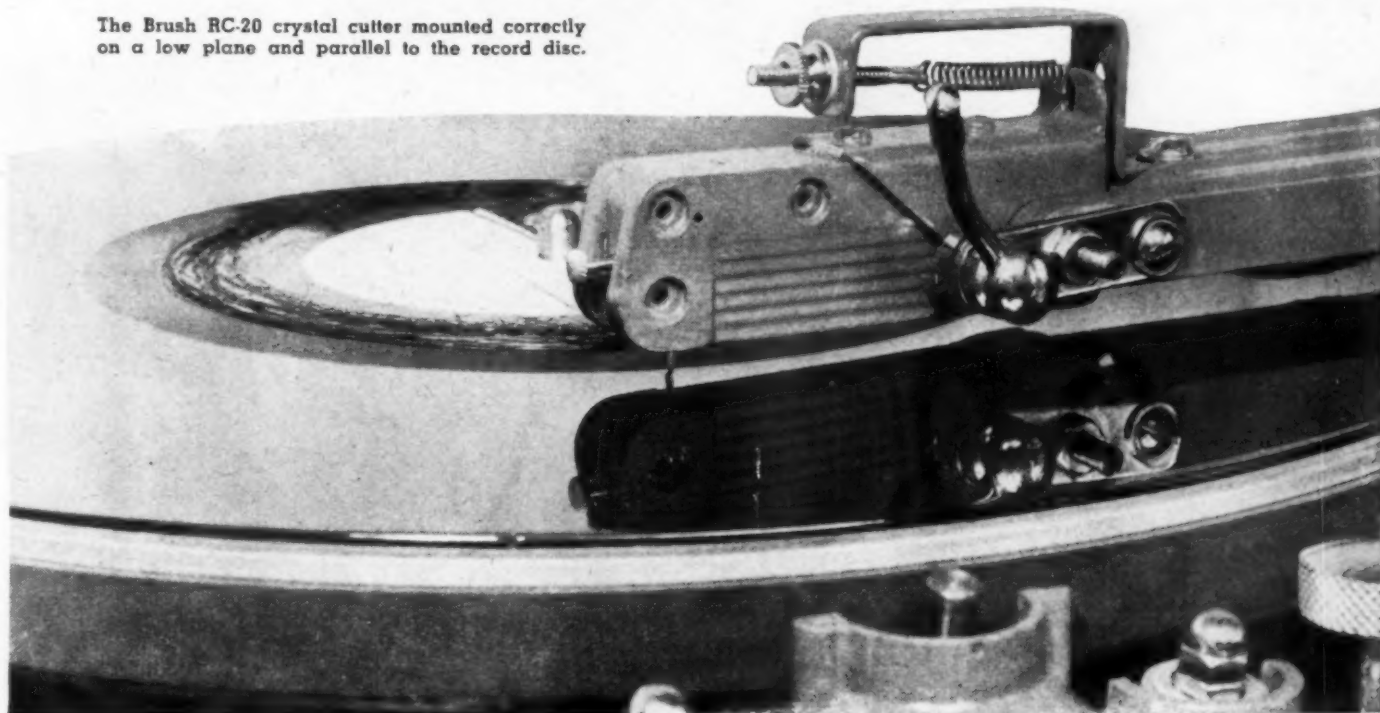
only produces an irritating effect, but has restricted the range of frequencies which could be reproduced if quieter conditions existed.

Measurements show that the noise components of disc records are definitely more pronounced in the higher frequency spectrum than in the lower regions. They are caused mainly by tiny irregularities in or on the record surface in the form of abrasives, grain, dust, dirt, etc. These irregularities, which are of random distribution, transmit scratch vibrations to the stylus of the phonograph pickup. Surface noise has been effectively reduced in some cases through the use of

scratch filters in reproducing circuits or in newer systems such as the *Scott Noise Suppressor*. This method of noise reduction has many advantages. Former methods, however, accomplished the above only with a decrease in high frequency response usually above 3000 cycles per second. This results in a so-called "mellowness," which some people prefer, but it cannot be considered good quality.

Some of the recent records made, particularly for radio transcription and sound studio use, are pressed from cellulose acetate or vinylite. Others are made by cutting directly on cellulose nitrate. The surface noise of these records is considerably reduced because of the smoothness of the material, and the fact that no abrasive has been added. These records are made under very accurately controlled manufacturing processes. Such records have provided from 15 to 20 db. improvement in signal-to-noise ratio over commercial shellac pressings. For best quality results, it is necessary to have these records reproduced with high fidelity phonograph pickups employing permanent jewelled styli of

The Brush RC-20 crystal cutter mounted correctly on a low plane and parallel to the record disc.



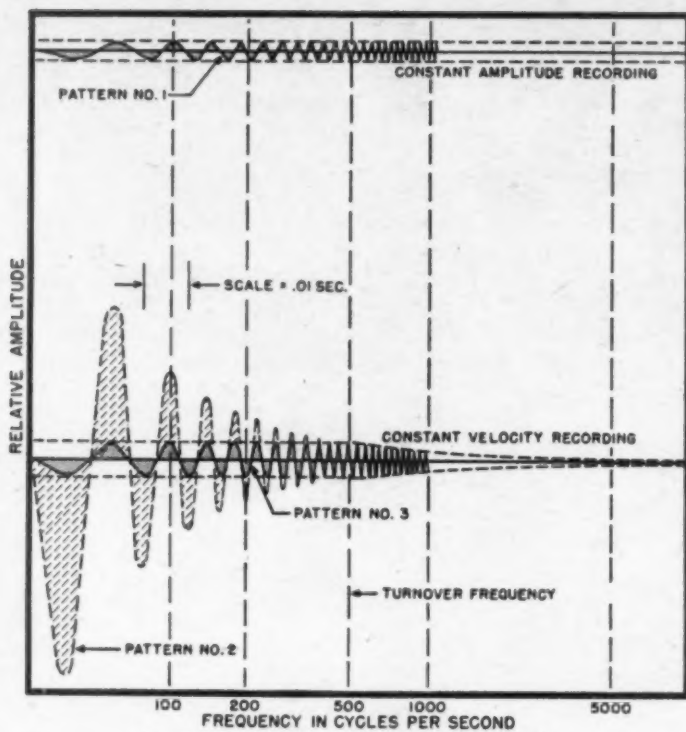


Fig. 1. Wave patterns for "constant amplitude" versus "constant velocity" recording.

optimum shape. In most cases a sapphire is used because of its smoothness and hardness.

While these quieter materials and improved methods of record manufacture contribute considerably to the reduction of surface noise it seems logical, since the noise components are more pronounced in the higher frequency spectrum, that additional noise reduction can be obtained by providing a higher signal-to-noise

ratio in this range during recording. This consists of increasing the amplitude of the higher frequency undulations in the record in such a manner that they are considerably higher than those created by the tiny irregularities in or on the record surface. This, of course, takes into consideration that during final reproduction the same relationship which existed in the original sound between the high and low frequency amplitudes will be maintained.

This method of noise reduction can be accomplished effectively through "constant amplitude" recording by using crystal cutters in recording and crystal pickups in reproduction.¹ Due to the inherent characteristics of these devices, this type of noise reduction requires no equalization in either the recording or reproducing circuits. It should be pointed out, however, that this sets a new standard in cutting and does not compare with the characteristics

as found on commercial phonographs. Therefore, discs cut constant amplitude should be played back only through proper systems and are not generally interchangeable with other types of amplifiers and reproducing systems.

Before discussing the advantages of constant amplitude recording, it may be well to explain how this method differs from constant velocity recording. In constant amplitude recording², constant sound pressure for all frequencies at the microphone (assuming an over-all uniform frequency characteristic up to the cutter) is represented by the same amplitude in the undulations cut in the record. Under these conditions constant velocity recording is represented by the same vibrational velocity, that is, the amplitude of the undulations cut in the record is inversely proportional to the frequency, viz.: $\text{Amplitude} = \text{Velocity} / \text{Frequency}$, but since the velocity is constant this may be written as $\text{Amplitude} = K (\text{constant}) / \text{Frequency}$.

In Fig. 1, which represents constant amplitude recording, it will be noted that the amplitude of the groove undulations (pattern No. 1) is constant regardless of the frequency. In pattern No. 2, which represents constant velocity recording, it will be noted that the amplitude of the groove undulations decreases as the frequency increases in such a manner that a frequency of 10,000 c.p.s. has only 1/100 the amplitude of 100 c.p.s. Wave patterns are shown which represent groove undulations for both methods of recording. These wave patterns, for purposes of illustration, are shown with progressive increase in frequency.

Since this method (pattern No. 2) would necessitate excessive amplitudes at the lower frequencies to obtain sufficient amplitude at the higher frequencies for satisfactory reproduction, commercial constant velocity records are usually cut constant amplitude from the lowest frequencies up to approximately 500 c.p.s., as indicated in pattern No. 3. This frequency is usually referred to as the "turn-over" frequency. This is also done to permit more grooves to be recorded without danger of crossover or echo effect.

Assuming that for average recording the amplitude for a frequency of 1000 cycles will be the same for constant velocity and constant amplitude recording, then the amplitude for a frequency of 5000 cycles for constant velocity recording will be only 1/5 the amplitude for constant amplitude recording. This, of course, takes into consideration that the cutters used in both methods of recording have a uniform characteristic, at least up to 5000 cycles per second.

It is apparent from the above that constant amplitude recording has an advantage over constant velocity re-

Fig. 2. (A) Microphone (generator) and (B) headphone (motor) action.

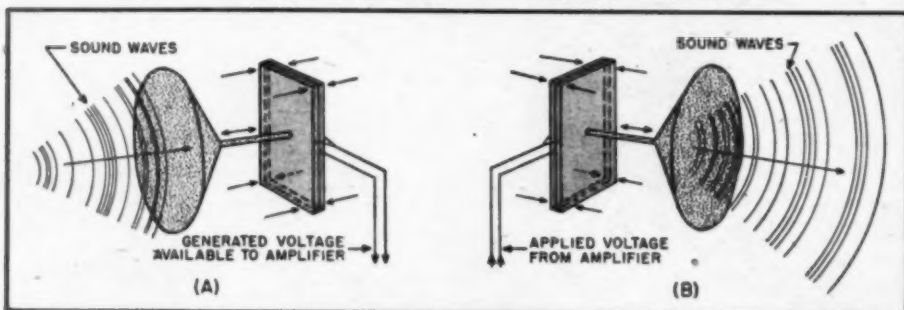
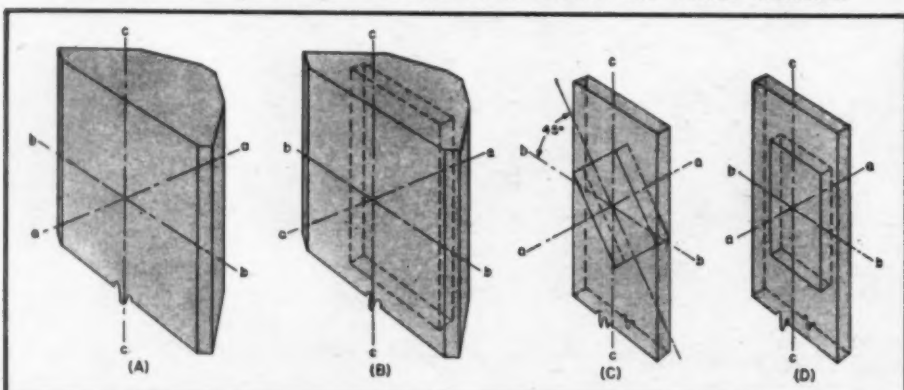


Fig. 3. Illustrating how crystals are cut to form "bender" and "twister" elements.



¹ Read, Oliver, "Build Your Own Recording Studio," Radio News, April, 1941.
² Technical Bulletin No. 291, "Brush RC-20 Cutter," Brush Development Co.

cording since the cutter automatically provides the higher amplitudes at the higher frequencies required for noise reduction during reproduction.

The crystal cutter such as the *Brush Model RC-20*, illustrated, is well suited for constant amplitude recording since its stylus displacement (amplitude) is proportional to the input voltages over its useful frequency range. Furthermore, due to the inherent stiffness of the crystal element, the amplitude and frequency response are practically unaffected by depth of cut and variations in hardness of recording materials. Considerable noise reduction also takes place in reproduction since the output voltages, as generated by the higher frequency sound undulations in the record, are considerably greater than the output voltages generated by the tiny irregularities in or on the record material. While it might appear that these higher amplitudes might interfere with the reproducing stylus tracking the grooves at these higher frequencies, this defect can be practically disregarded considering the fact that both speech and musical sounds contain much less energy for the higher frequencies than they do for the lower frequencies. Furthermore, high fidelity crystal pickups are available with low vibratory inertia and styli of small radius of curvature which are capable of tracking high frequency undulations of rather high amplitude.

It is impractical to give definite values of noise reduction resulting from constant amplitude recording since the surface noise in disc records, due to the random distribution of the surface irregularities, varies in degree and frequency spectrum. In general, constant amplitude recording has provided noise reduction of from 6 to 10 db., as compared to commercial constant velocity recording using the same type of recording materials. In subjective tests, because of the irritating nature of the surface noise, this noise reduction appears even greater.

Characteristics of Crystal Elements

Certain crystalline substances exhibit the phenomenon of piezo- (pressure) electricity, i.e., when they are stressed mechanically an electric charge is produced and, conversely, when a voltage is applied, mechanical deformation of the crystal takes place³.

In the first case, the piezoelectric crystal may be likened to a generator since it converts mechanical motion into electricity. Crystal microphones and phonograph pickups (Fig. 2A) are common examples of piezoelectric generators. In the second case, the piezoelectric crystal may be likened to a motor (Fig. 2B) since it converts electricity into mechanical motion. Crystal headphones and record cutters are good examples of the latter.

Considerable research has been done

in developing the piezoelectric crystal for use in sound and other devices.

Such crystals are of the common crystalline form of Rochelle salts (sodium potassium tartrate). These crystals possess piezoelectric properties to a greater extent than any other known material, being approximately 1000 times more active than quartz crystals. The crystals are first grown in large, clear homogeneous bars about two feet long. These bars are cut into slabs and then into the small plates used in the final crystal elements.

The properties of these crystal plates may be expressed in terms of three axes, *a*, *b*, and *c*, as shown in (A) of Fig. 3. The more common crystal plates are cut perpendicular to the *a* axis because in Rochelle salt

(Continued on page 130)

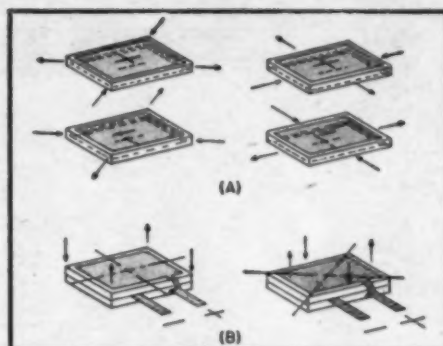


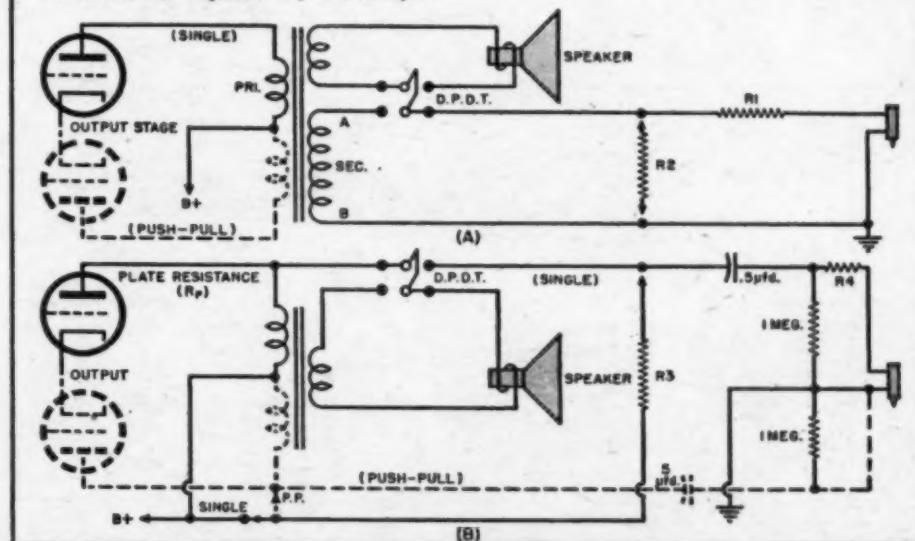
Fig. 4. (A) Single electrode plates in relative pre-assembled positions. Arrows show directions of maximum instantaneous strains for the indicated applied voltage polarity. (B) Arrows show location and direction of maximum motion of the element relative to the indicated axis.

Fig. 5. (A) Schematic diagram shows cutter connected across transformer secondary. (B) Diagram shows how cutter may be connected directly across plates of output tube. Table shown gives component values for either constant amplitude or constant velocity recording. Class "A" or "AB" single or push-pull output tubes should provide an undistorted output of at least 3 watts.

METHOD OF RECORDING	TRIODES	PENTODES OR BEAM POWER (With Stabilized Feedback)	PENTODES OR BEAM POWER (Without Stabilized Feedback)
"Constant Amplitude" (See Fig. 5A)	R ₁ —Omit R ₂ —Omit Sec.—Select transformer so that reflected impedance at A-B is not over 4000 ohms.	R ₁ —Omit R ₂ —Omit Sec.—Select transformer so that reflected impedance at A-B (as modified by feedback) is not over 4000 ohms.	R ₁ —Omit R ₂ —3000 to 4000 ohms. Sec.—Select transformer for load impedance at A-B of 3000 to 4000 ohms.
"Constant Amplitude" (See Fig. 5B)	R ₁ —Omit R ₂ —Omit *R _p —Not over 4000 ohms.	R ₁ —Omit R ₂ —Omit *R _p (Effective)—Not over 4000 ohms.	R ₁ —Recommended load impedance of vacuum tube. R ₂ —Omit R _p —Select vacuum tube so that recommended load impedance is not over 7000 ohms.**
Commercial "Constant Velocity" (See Fig. 5A)	R ₁ = 1/2 Z _T (See Fig. 7) R ₂ —Omit Sec.—Select transformer so that reflected plate impedance at A-B is equal to 1/2 Z _T . (See Fig. 7)	R ₁ = Z _T (See Fig. 7) R ₂ —Omit Sec.—Select transformer so that reflected plate impedance at A-B (as modified by feedback) is equal to 1/2 Z _T . (See Fig. 7)	R ₁ = 1/2 Z _T R ₂ = 1/2 Z _T (See Fig. 7) Sec.—Select transformer for load impedance at A-B equal to R ₁ .
Commercial "Constant Velocity" (See Fig. 5B)	R ₁ —Omit R ₂ = Z _T (See Fig. 7)	R ₁ —Omit R ₂ = Z _T (See Fig. 7)	R ₁ —Recommended load impedance of vacuum tube. R ₂ = Z _T (See Fig. 7)

*In case of push-pull, R_p equals plate resistance of both tubes.

**Provides flat response only to 3500 c.p.s.



³ Technical Bulletin No. 310, Brush Development Co.

Practical TRANSFORMER DESIGN and CONSTRUCTION

By C. ROESCHKE

Part 2. Complete details for designing and constructing your own iron core reactors.

LAST month we discussed the design and construction of various types of power transformers used in the radio field. This month data relative to the proper design of filter chokes will be covered.

Iron core reactors are used primarily because they provide a smaller size unit for a given value of inductance at power or audio frequencies. The points to consider in the design of such a choke or reactor are:

1. Magnitude of inductance (in henries) required
2. Magnitude of direct current which will flow in the coil during operation

3. Iron size required to provide unit having desired inductance

Obviously, the unit can not be designed until the amount of inductance required has been established. This is, of course, determined from the anticipated operation of the circuit in which the choke is to be used.

Similarly, the value of direct current which will be flowing in the coil depends on the circuit operation.

Fig. 9 has been worked out to be used for filter choke design calculations. The filter chokes referred to here are those used in power supplies for receivers or transmitters.

The iron size required for a given

value of inductance will depend primarily on the magnitude of the direct current involved. This is because coils which carry large currents must be wound with large size wire. To use a given number of turns of large wire, you must, of course, use a large size lamination which has enough room for the coil. Also, the iron size employed for chokes carrying high direct current must be large to avoid saturation of the core by this high current.

Fig. 13 gives the data on the lamination size required for various filter chokes and will serve as a rough guide in design work.

The following calculations show all steps in the design of a filter reactor, assuming that a choke of these specifications is required: Inductance, 5 hy; Direct current in coil 200 ma.

By consulting Fig. 13, we see that the approximate lamination size is $1\frac{1}{8}$ " iron so we shall try to design this unit using $1\frac{1}{8}$ " laminations with a stack of $1\frac{1}{8}$ ".

Fig. 5* indicates that No. 29 wire will carry the 200 ma. direct current.

Now, let us try to use about 2500 turns of wire. We shall have to check to see if a coil of this size will fit into the $1\frac{1}{8}$ " iron. According to Fig. 8,* we can wind 103 turns per layer of No. 29 wire on a coil for $1\frac{1}{8}$ " iron, which means that 25 layers will be required for the 2500 turns. Let us calculate the size of this coil:

Tube thickness050"
25 Layers of .002" Paper050"
25 Layers of #29 Wire305"
Outside Wrapper (2 of .007 Paper)015"
		0.420"

The space available in the core (dimension *F* of Fig. 1*) is 0.562. Our coil

build is $\frac{0.42}{0.562} \times 100 = 75$ per-cent

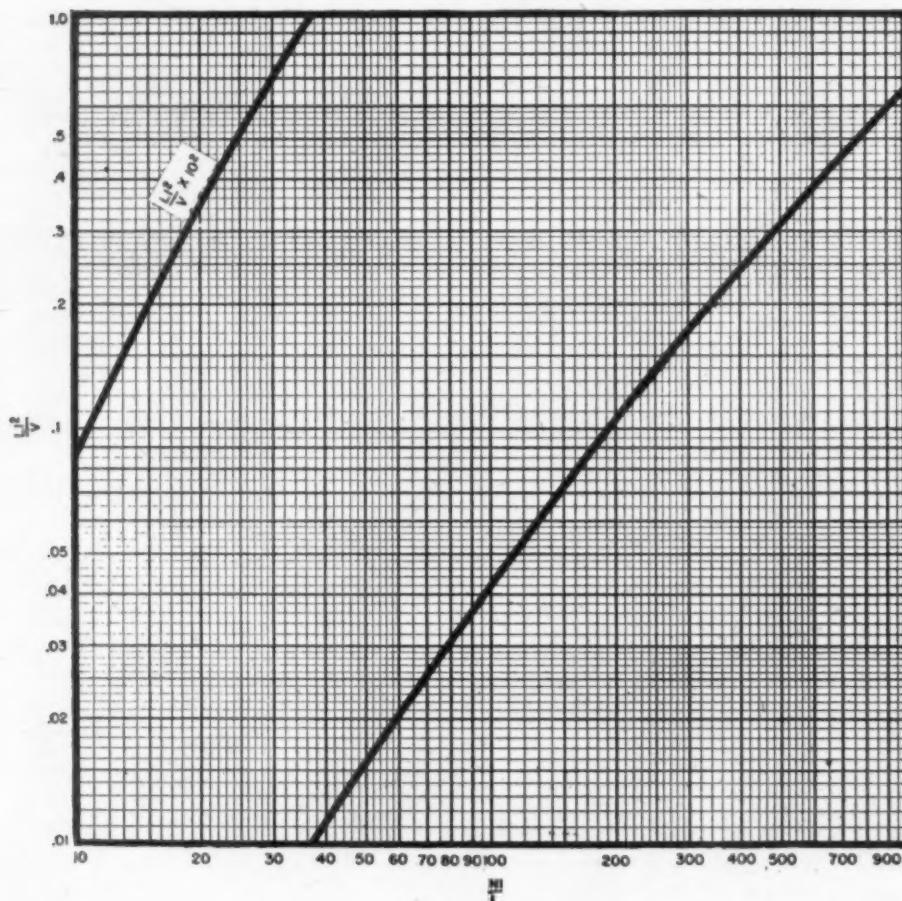
which means that the coil will fit nicely.

We do not yet know if this unit will provide the required inductance of 5 henries. Therefore, our final step is to calculate what the inductance of this unit will actually be.

* Figs. so designated appeared in Part I of this article published in the June issue of Radio News.

RADIO NEWS

Fig. 9. Simplified chart that can be used in designing filter chokes.



First, we calculate NI/l where: N = number of turns in the coil; I = direct current flowing in coil (amperes); l = length of magnetic path of core in inches.

The length of the magnetic path in cores using various size laminations is shown in Fig. 11.

$$\frac{NI}{l} = \frac{2500 \times 0.2}{6.75} = \frac{500}{6.75} = 74.2$$

Here we shall employ the graph of

Fig. 9 to find $\frac{LI^2}{V}$ where: L = induc-

tance in henries; I^2 = direct current in amperes, squared; V = volume of core in cubic inches. This is the total volume of all of the core.

This graph shows that when $NI/l = 74.2$ then $LI^2/V = .0275$, approximately. By transposition in this equation we see that $L = .0275V/I^2$ and this is the formula we use to find the inductance L of our choke.

Thus:

$$L = \frac{.0275 \times 8.55}{0.2^2} = 5.87 \text{ henries}$$

This is a satisfactory design and the actually measured inductance would be within 10 or 15 per-cent of this value depending on the characteristics of the iron used.

At this time, assume that we also want a choke having an inductance of 7 henries at 200 ma. d.c. Since we have a design which gives us 5 hy. at 200 ma. we can arrive at a design for 7 hy. merely by adding more iron in the core. By juggling our formula, we can find the volume of core required for 7 henries.

Since $L = \frac{.0275V}{I^2}$ we see that

$$V = \frac{LI^2}{.0275}$$

Then $V = \frac{7 \times 0.2^2}{.0275} = \frac{7 \times .04}{.0275} = 10.2$ cubic inches (approx.)

which is the volume of core required for inductance of 7 henries. It is only necessary then to increase the number of pieces of iron in the core to make the stack dimension large enough to provide 10.2 cubic inches of volume. In this design our stack would then be about $1\frac{7}{16}$ " instead of $1\frac{1}{8}$ ".

Fig. 14 is used in the following manner to calculate what amount of wire will be required in a coil and to estimate the d.c. resistance.

A and B are inside dimensions of the winding tube.

Assume that $A = 1\frac{1}{8}$ ", $B = 1\frac{7}{16}$ " and that the coil is wound with 2500 turns of No. 29 wire. Also, assume that 25 layers were required. Then, dimension K is equal to:

1.125" dimension A
.050" tube thickness
.050" 25 layers of .002" paper
.300" 25 layers of #29 wire

1.525"

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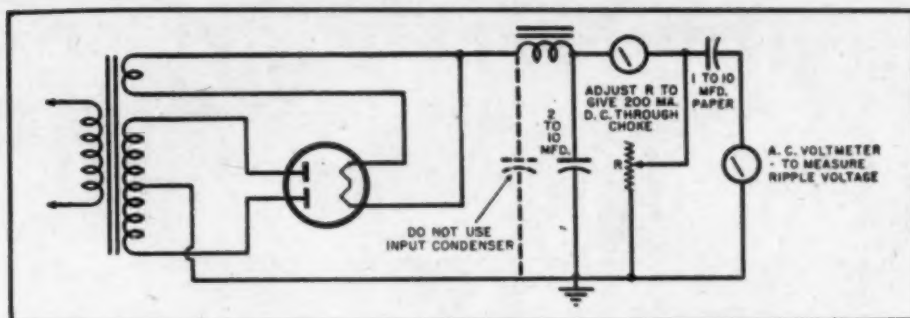


Fig. 10. Test circuit that can be used to determine proper core gap experimentally.

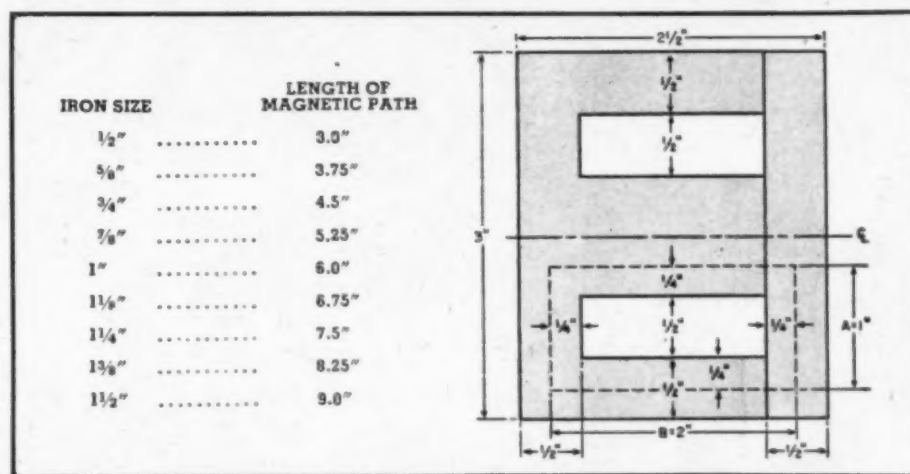
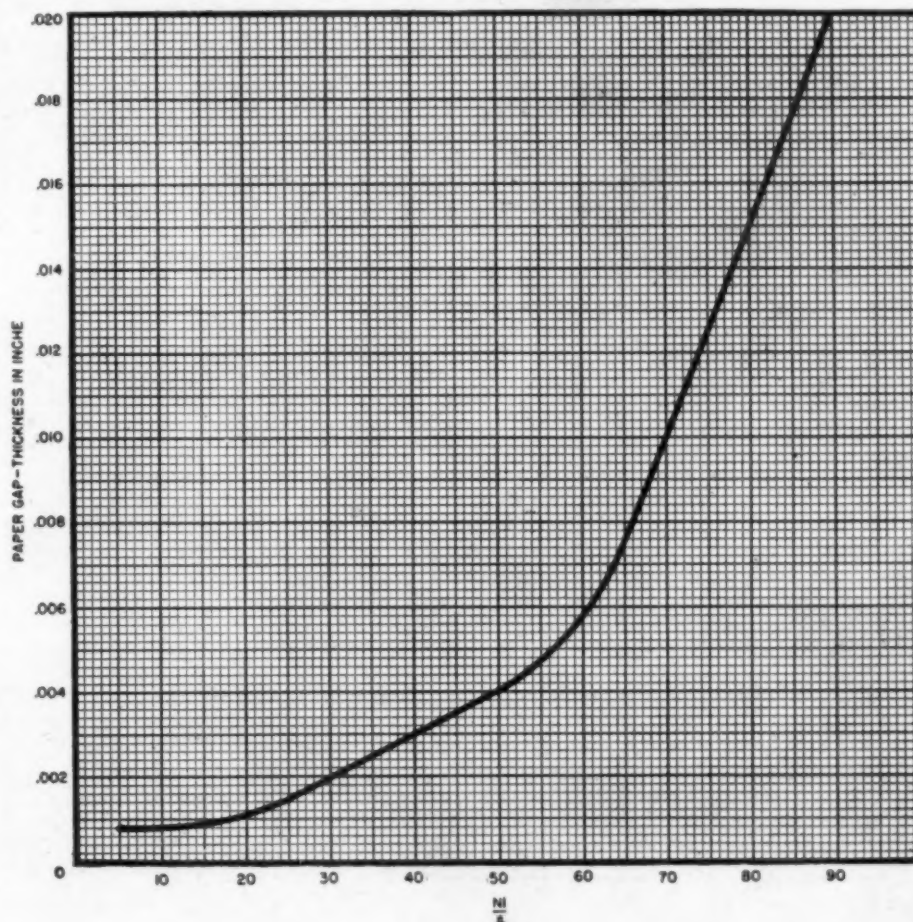


Fig. 11. Diagram shows method of measuring length of magnetic path. The dotted line is the mean path and equal to $A + A + B + B$ or, as in this case, $1 + 1 + 2 + 2$ or 6". Table gives magnetic path lengths of various standard sizes of laminations.

Fig. 12. Graph used to determine approximate thickness of gap to be placed in core.



Output Transformer Impedance Matching

By **ROBERT B. TOMER**
Chief Eng., Symphonic Radio & Electronic Corp.

Simplified chart provides output transformer turns ratio without lengthy mathematical calculations.

TRANSFORMER impedance matching is a problem frequently encountered by the experimenter or serviceman. Usually, a transformer is obtainable which is designed by the manufacturer to do the particular job desired and it is only necessary to connect the unit as indicated to obtain entirely satisfactory results. There are occasions when such a transformer is not readily available or where the individual already has several good transformers on hand whose specifications have become lost. It is possible, especially in the case of output transformers, to use one transformer to do

a large variety of quite different jobs. The reason for this is that a transformer used to couple a tube into its load, never acts as the load itself, but only as the means for "reflecting" or translating a load of one characteristic into a load of another characteristic such that it corresponds to the optimum value for the tube being used.

Transformers reflect impedance from one circuit to another in direct relationship to their turns ratios. The turns ratio is the ratio of primary turns to secondary turns. Impedance is reflected as the square of this ratio. That is, if the turns ratio is 2 to 1 the

impedance across the primary will be reflected into the secondary as 4 to 1. When the turns ratio is 3, the impedance ratio will be 9, etc. The turns ratio of any transformer can be determined with reasonable accuracy by measuring the voltage ratio since in a perfect transformer they would be identical. The voltage ratio can be measured by placing any known a.c. voltage across one winding and measuring the resulting induced voltage across the other winding. For best results the voltmeter used for these measurements should draw little or no power, but even a very simple rectifier type a.c. voltmeter will give results that are entirely adequate for all practical purposes.

In order to determine what turns ratio is necessary to couple a given tube to a given loudspeaker voice coil, it is useful to know the formula:

$$\text{Turns Ratio} = \sqrt{\frac{\text{Load Resistance of Tube}}{\text{Voice Coil Impedance}}}$$

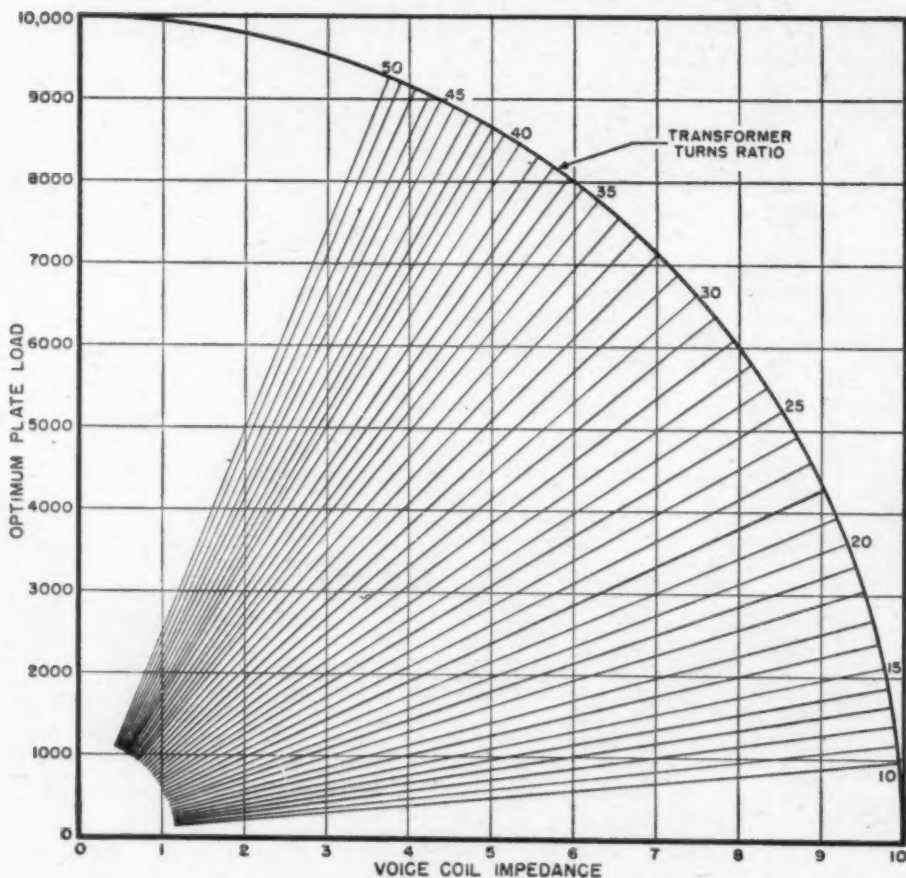
This says that the square root of the optimum load resistance of the tube, as taken from the manufacturer's specifications in a tube manual, divided by the voice coil impedance is equal to the turns ratio. For example, if it is desired to couple a 50L6 to a speaker having a voice coil impedance of 3.5 ohms, what turns ratio is required?

$$\sqrt{\frac{2000}{3.5}} = \sqrt{570} = 24 \text{ Turns ratio}$$

This same information can be obtained from the chart without the need of calculation by drawing a line through the 3.5 position on the lower reference line and continuing upward until it intersects the 2000 ohm line and then following the oblique line upwards and to the right until it intersects the outer arc. At this point the proper turns ratio can be read directly.

Through the use of this chart it becomes possible to adapt many transformers for uses other than those for which they were originally designed. A transformer originally designed for use with a 50L6 and a 3.5 ohm voice coil would have a turns ratio of 24. This same transformer could be used to match a 6V6 into an 8 ohm voice coil. Or two 3.5 ohm voice coils could be connected in series, with a small loss of power in each speaker, and used in conjunction with this same transformer and the 6V6. Output transformers usually have their voice coil windings on the outside so that it becomes very easy to remove a few turns if it is desired to raise the turns ratio. This same transformer could be changed from a turns ratio of 24 to one of 30 or 35 by removing a few turns from the outside winding. Thus, many possibilities are available to the experimenter or serviceman through the use of this simple technique. Even the multi-tap transformer can be put to more varied use by this method and in case the chart which comes with it has been lost, you can determine for yourself what the various taps can be used for.

Chart that may be used to determine turns ratio of output transformers.



A Pocket Signal GENERATOR

By
J. R. BLUNDIN

Although not intended to replace a conventional signal tracer this gadget provides an r.f.-i.f. and a.f. signal source for rapid signal tracing.

IT IS OFTEN desirable when checking a radio receiver, to get an over-all picture of the operating condition of the various stages quickly so as to roughly determine the cause of the trouble without removing the chassis from the cabinet. A quick way of doing this is to inject a signal of suitable frequency into the set and listen for continuity of signal through the speaker to determine if there are any dead stages or not. It may not always be feasible to use a bench signal generator for this purpose inasmuch as the set may be away from the shop or installed in a car. The pocket signal generator described here is useful for this purpose and because of its extreme flexibility can be carried along on remote jobs as a signal source for r.f., i.f. or a.f. use.

Construction

This signal generator was built from a discarded flashlight and a small high frequency buzzer. The front end of the flashlight was dismantled with the lens, reflector, bulb and socket being removed. All parts were retained for future use except the lens. In this particular flashlight the bulb socket was mounted on a fiber disc and this was used to support the buzzer. Two small angle brackets were used to fasten the buzzer to the fiber ring so as to provide clearance under the buzzer to insert the base of a bulb, which was used to make electrical connections with the bulb socket.

As it was necessary to insulate the buzzer shell from the case of the flashlight, a bakelite ring was cut the same size as the fiber disc and the buzzer mounting brackets clamped between these two insulated discs. The bakelite and fiber discs are held together by two small bolts which must not touch the angle brackets. Details of

this assembly can be seen in the photograph. Electrical connections to the buzzer were made through wires soldered in the base of a flashlight bulb from which the glass had been removed, using the bulb base as a plug, to screw into the socket under the buzzer.

As the case of the buzzer is connected to the vibrator arm contact, it is used as a suitable take-off point for connection of the output condenser. This is an .01 mica mounted on top of the buzzer case as shown in the photo. One side is connected to the mounting screw on the side of the buzzer case, the other lead is shown bent up and terminating in a short pigtail. This is connected to a tip jack mounted in the center of the reflector. The existing hole in the reflector was too large for the tip jack so a rubber grommet was used to give the assembly a cushion effect, the outside of the tip jack merely being pushed in the grommet. This allows some play when assembling. The underside of the reflector with the tip jack

An ordinary flashlight case is used to house this unique unit.

and grommet attached can be seen in the photograph of the disassembled unit. The reflector is used backwards, however, when assembled, as can be seen in the completed picture. When assembling, care must be exercised to insure that the case of the buzzer does not touch the case of the flashlight else the circuit will be completed without the use of the pushbutton and the buzzer will be "on" continually. Friction tape can be used to cover up the buzzer before inserting it in the flashlight case. The reflector should be placed over the condenser so as to make contact between the tip jack and the condenser pigtail and the retaining ring then screwed down over the whole business. Tighten the ring

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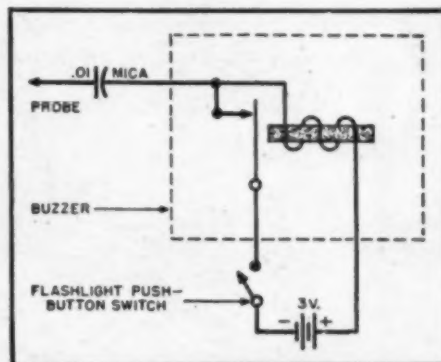
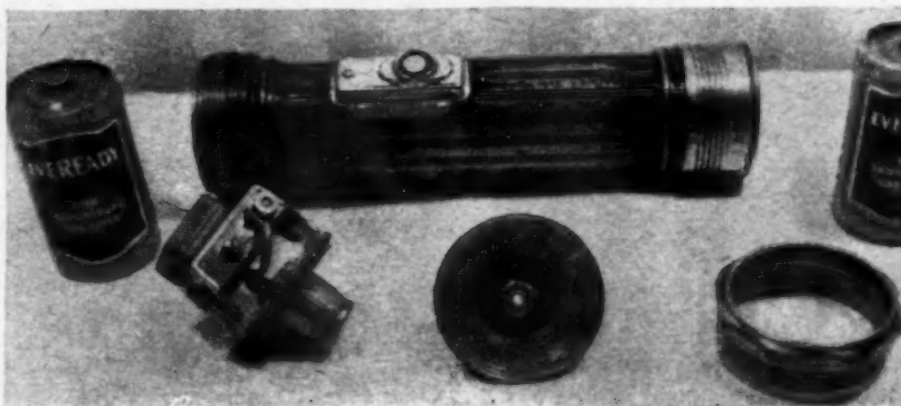


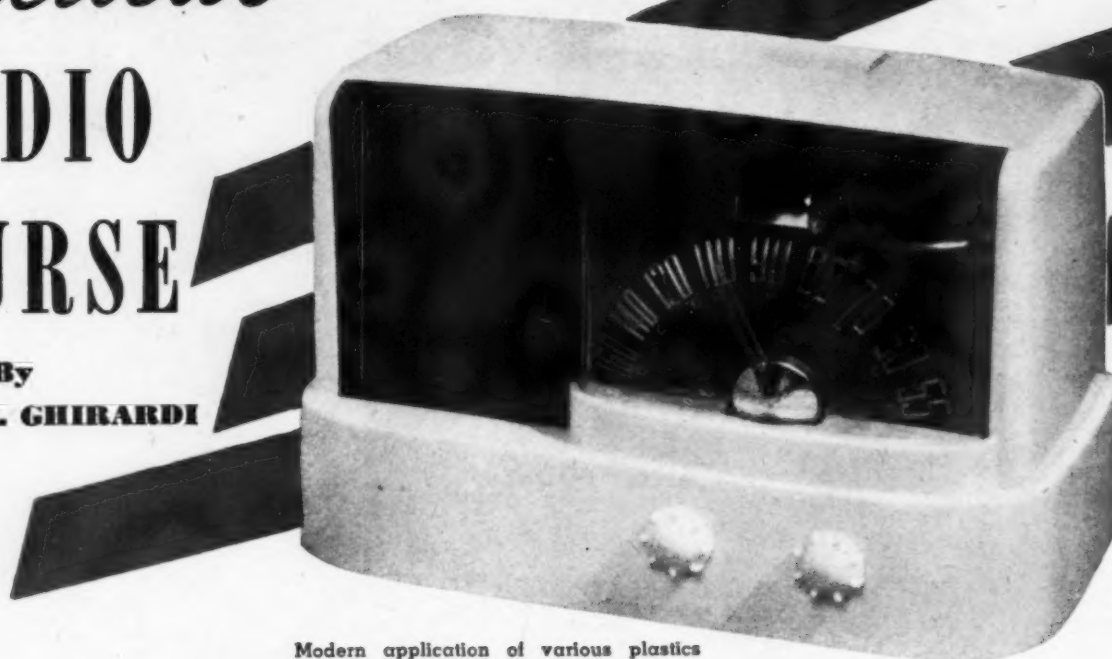
Diagram shows buzzer wiring. Any type of buzzer may be used, however, the higher its frequency of operation the more versatile will be its application.

All component parts needed to build this signal tracer are shown in this photo.



Practical RADIO COURSE

By
ALFRED A. GHIRARDI



Modern application of various plastics provides streamlined housing for this new, compact Emerson table model radio.

Part 54. A typical sound i.f. amplifier, factors that determine the number of i.f. amplifier stages needed in a superheterodyne, i.f. selectivity and band-pass response characteristics required in AM receivers.

THE intermediate-frequency amplifier is that part of a superheterodyne that lies between the frequency converter and the detector or demodulator in a AM receiver, and between the frequency converter and the limiter in a FM receiver (see Fig. 1). It is essentially a fixed-tuned amplifier which derives its input signal from the plate circuit of the frequency converter, since this is the point at which the signal first appears at intermediate frequency.

Functions of the I.F. Amplifier

The i.f. amplifier has three important duties to perform in a modern su-

perheterodyne receiver. It is required to provide:

1. Sufficient amplification of the desired-signal voltage in order to provide a satisfactory amount of gain at the intermediate frequency.
2. A suitable pass-band acceptance response characteristic that depends upon the type of receiver, so that it will amplify and pass on both the i.f. carrier and all transmitted side-band frequency components of the desired signal that are considered important for its reproduction with acceptable fidelity.
3. Sharp attenuation to below audibility of all carriers (and their side-

band frequency components) in the adjacent upper, and lower, transmitting channels, so that any adjacent-channel signals that may succeed in getting to the plate circuit of the frequency converter will be attenuated to below audibility.

4. A satisfactory place in the receiver at which to make possible the application of *automatic volume control* (a.v.c.) if desired (usually in AM amplifiers only).

Satisfactory fulfillment of requirement 1 is often closely dependent upon requirement 2.

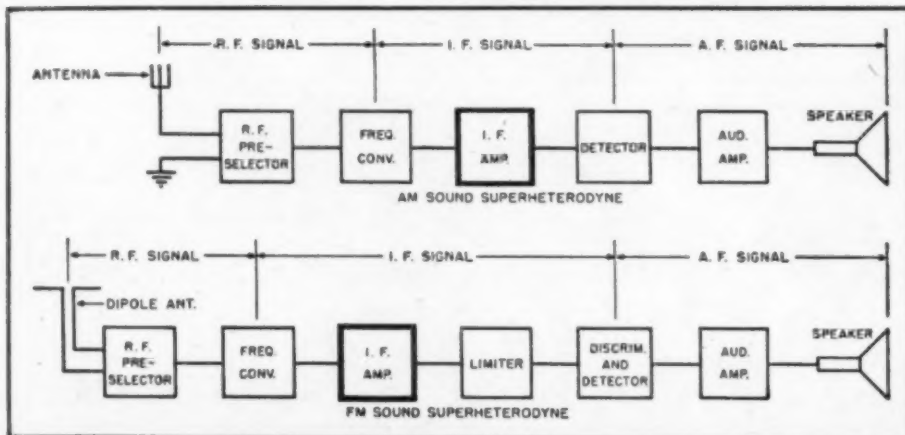
As all four of these requirements are extremely important to the successful operation of the receiver, they must be considered in the design of the i.f. amplifier. Each will be discussed in detail at an appropriate place.

Elements of a Typical I.F. Amplifier Stage

The i.f. amplifier must build up the signal voltage preparatory to its being demodulated by the detector. It should perform this amplification at the greatest practical efficiency per stage, and it should accomplish this without causing any distortion in the varying waveform of the desired signal.

Fig. 2 shows the elements of a simple transformer-coupled single-stage i.f. amplifier for an AM receiver. It contains a single high-gain r.f. pentode amplifier tube for amplification and four tuned circuits for obtaining the required selectivity and band-pass characteristics. It operates essentially like the tuned radio-frequency amplifier explained in a previous article of this series—excepting that its four tuned circuits remain adjusted to resonance at a fixed frequency—the

Fig. 1. Position of i.f. amplifier in relation to the other main units in AM and FM receivers. Type of signal in each is indicated.



intermediate frequency employed in the receiver. Consequently, the i.f. amplifier is really a special case of a radio-frequency amplifier operating at a fixed frequency.

The i.f. coupling transformer that serves here to couple the plate circuit of the frequency converter tube to the grid circuit of the i.f. amplifier tube, and the one that couples the plate circuit of the i.f. amplifier tube to the input circuit of the detector, are of a type that have been used for many years—although other types that will be explained later are now being employed in some classes of receivers. Each consists of magnetically coupled (closely) primary and secondary windings, *P* and *S* which, ordinarily, are similar. Each winding is tuned by an adjustable capacitor shunted across it. The capacitance of each of these tuning capacitors is made adjustable over a limited range such that the coil it is associated with can be tuned to resonate at the intermediate frequency employed in the amplifier. These capacitors are then left at this adjustment, unless it later becomes necessary to realign or retune the amplifier.

The effect of the two tuned, closely coupled circuits supplied by each i.f. transformer is to make it possible to provide a particular desired response characteristic (usually of bandpass type) whose mid-frequency is set at the intermediate frequency of the receiver. More about this in a later article of this series!

High-gain r.f. pentodes of the type known under the various names "super-control," "remote cut-off" and "variable-mu" are, of course, the most logical i.f. amplifier tubes to use since they have extremely low grid-to-plate capacitance for maximum circuit stability, high plate resistance for minimum loading of the tuned circuits, high μ and high transconductance for high gain. Such remote cut-off types are preferred to sharp cut-off types to prevent cross-modulation from strong local signals when the volume control is set for low sensitivity, and to permit a wide range of a.v.c. action (in AM receivers) without detuning.

Number of I.F. Stages Required

Since the tuned r.f. amplifier (pre-selector) stages ahead of the frequency converter—if any are used—and the frequency converter stage both

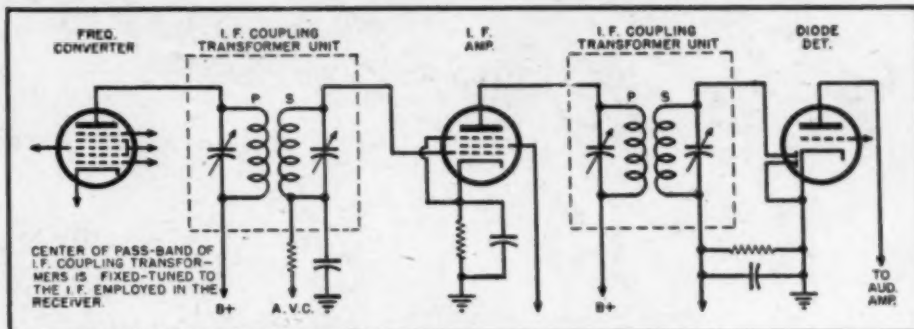


Fig. 2. Elements of typical single-stage i.f. amplifier between the frequency converter and diode detector of a conventional AM receiver.

produce comparatively little r.f. gain, the gain produced in the high-gain fixed-frequency intermediate amplifier is important, since a major portion of the over-all r.f. sensitivity of the entire receiver is dependent upon it. This is especially true in v.h.f. receivers (FM broadcast, television, etc.) since the incoming signal frequencies in these are so high.

Because the present-day practice of employing relatively inefficient minimum-size types of antennas with many classes of radio receivers makes high over-all sensitivity in these receivers necessary, it is desirable that as much gain as possible be achieved in the i.f. amplifier. The limiting factor is the equivalent grid circuit noise voltage of the frequency converter tube employed.

Despite this present-day requirement for high r.f. sensitivity, fewer stages of i.f. amplification are necessary in modern receivers than were required in the earlier days of the superheterodyne. This is due mainly to the appreciable improvements that have been made in i.f. interstage coupling transformer design and in the higher gain per stage now obtainable as a result of the development of high-gain r.f. pentode amplifier tubes that are suitable for use in i.f. amplifiers.

From the standpoint of gain and sensitivity, it is not now generally necessary to use more than a single i.f. stage when an i.f. below about 600 kc. is employed. It will be found that most modern AM broadcast band receivers (which use an i.f. in the neighborhood of 455 kc.) now employ but one i.f. stage, although it was fairly common practice to employ two i.f. stages in such receivers a few years ago. The

(Continued on page 98)

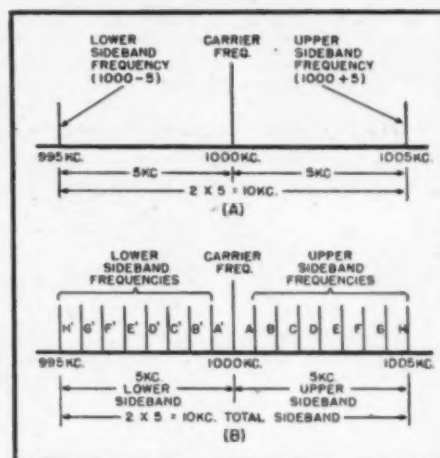


Fig. 3. Illustrating production of sideband frequencies in amplitude modulation: (A) by single modulated frequency and (B) by a number of modulated frequencies.

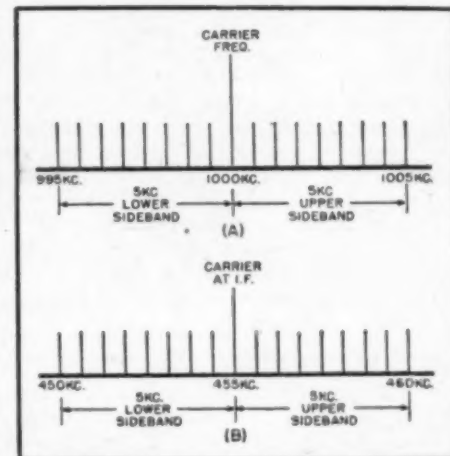
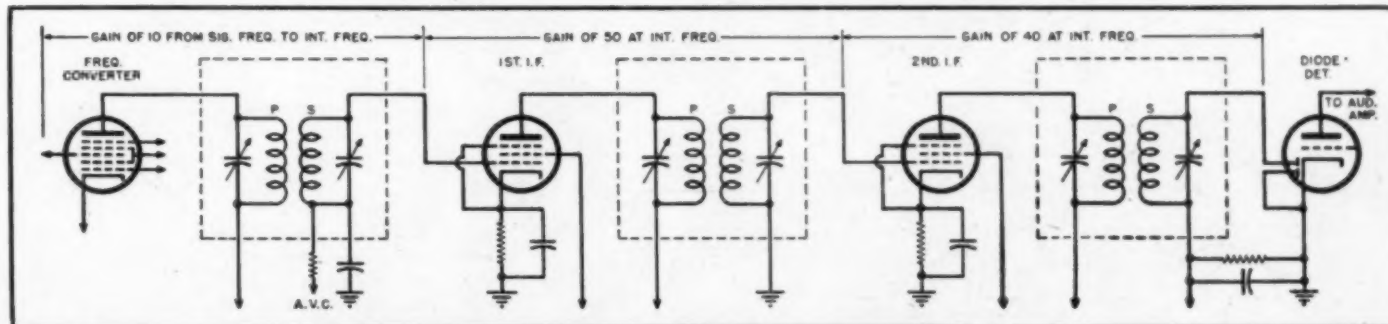


Fig. 4. Low fidelity amplitude modulated signal and its various sidebands before and after frequency conversion.

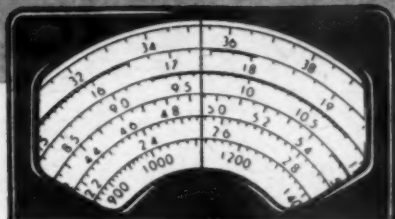
Fig. 5. Elements of two-stage transformer-coupled i.f. amplifier. Note that two i.f. tubes and six tuned circuits are used.





International SHORT-WAVE

Compiled by **KENNETH R. BOORD**



IT IS with pleasure this month that we dedicate the ISW Department to radio in Jamaica—largest and most valuable of the British West Indies, island that figures largely in the history of the Buccaneers of the West Indies before and during the time of Sir Henry Morgan, who was once its Governor.

We are indebted to B. C. Stone, M.I.R.E., senior engineer of the Wireless Transmitting Station Branch, Stony Hill, of Cable and Wireless (West Indies) Limited, for this data.

Shortly after the outbreak of war in September, 1939, the well-known estate owner and radio amateur, John F. Grinan, presented his transmitter to the Government for use as a broadcasting station. The transmitter (now ZQI) is located at a modern private house at No. 2 Seaview Avenue in St. Andrew, Kingston, and operates on 4.7 in the afternoon and 2.3 at night.

The station gives a 4-hour daily broadcast, 1600-1730 and 1930-2200,* when this is necessary.

Through the cooperation of local firms operating public address equipment, and the Jamaica Telephone Company Limited, it has recently been arranged to occasionally give broadcasts from places other than the

studio. For instance, during the recent visit of Colonel Oliver Stanley to Jamaica, arrangements were made to broadcast his speech from the Ward Theatre. Similarly was Sir John Huggins' speech at the opening of the New House of Representatives in 1945 broadcast. During the recent visit of the Trinidad Cricket Team to the Island, the details of all the Test Matches (Trinidad versus Jamaica) were successfully broadcast from Sabina Park. Even more recently, the ceremony of Consecration of the first Suffragan Bishop of Kingston was transmitted, including a later broadcast of the Civic Reception in connection with the event.

Officials of ZQI point out that an effort is made to maintain a well-balanced schedule of programs, during which the best local talent is properly interspersed with discourses on subjects of public interest and given by Jamaica authorities. No definite plans for the future have yet been outlined, but developments in the comparatively near future are anticipated.

On the 1600-1730 transmission over 4.7, headline news is read at the beginning of the period (following a program preview), with detailed news at 1715; on the 1930-2200 period over 2.3, news is read at 2100. The news bul-

letins cover both affairs at home and abroad. In addition to news, there are cultural talks, entertainment (including BBC and AFRS transcriptions as well as programs presented by local talent), and other miscellaneous variety items.

ZQI, which has been on the air since November 17, 1939, is situated in the outskirts of Kingston, the capital. The transmitter was built locally, mostly of American-made equipment. The final stage power at present is about 1200 watts.

The station is operated by the Jamaica Government, under the management of Denis Gick, who has had considerable broadcasting experience both in Canada and the United States.

During the last two years, ZQI has branched out into "outside broadcasts" with much success; the people of Jamaica, very keen on sports, have been treated to excellent commentaries on Inter-Colonial cricket and football matches. During the cricket matches against a visiting Trinidad team last year—and in the more recent series of football matches with Trinidad—it was decided that the people of Trinidad (also ardent sports fans) should be kept informed of the progress their players were making on the field of play at Sabina Park, Kingston. As the frequency (4.7) used for the running commentaries is unsuitable for long-distance daytime transmission, ZQI could not be heard direct in Trinidad. This difficulty was overcome with the cooperation of Cable and Wireless Limited, which picked up the ZQI broadcast at their receiving point, Fairview, Kingston, and re-transmitted the program over their short-wave transmitter, VRR4 at Stony Hill. This transmitter puts out about 2.5 kw. high-frequency power on 11.595; a further transmitter, VRR5, operates on 12.050. The series of five re-broadcasts thus performed was received successfully by Radio Redistribution Limited in Trinidad and was distributed from Port-of-Spain for the benefit of that Colony's audience. However, not only Trinidad fans found interest in these broadcast commentaries, for favorable reports on reception of these transmissions have since come in from the United States, England, Sweden, and South Africa. In

General view of Stations VRR4 (11.595) and VRR5 (12.050), Stony Hill, Jamaica. These stations are used chiefly for relaying sports and other events from SW station ZQI, Kingston. Transmitter building is at right, quarters and storerooms may be seen in center of photo.



* Unless otherwise indicated, all time herein is expressed in American Eastern Standard Time, using the 24-hour clock system; for GCT, add 5 hours; "news" refers to newscasts in English.

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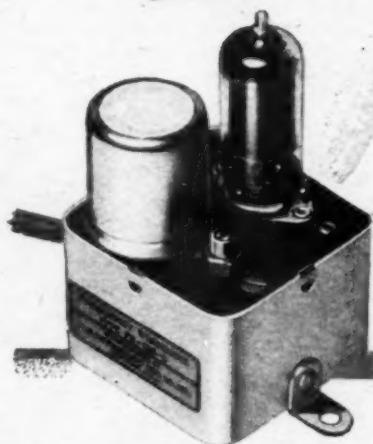
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view of the success of these re-broadcasts, it is expected that the services of VRR4 and VRR5 will be utilized more widely in future.

The Stony Hill station uses a Marconi SWB8W transmitter, with an input to the final stage of about 3.5 kw. (700 ma. at 5000 volts). Stony Hill is 1500 feet above sea level, and is located about 12 miles from Kingston.

ZQI and the VRR stations verify.

There are no medium-wave stations in Jamaica.

* * *

Special DX Sessions

Starting June 1, *Radio Australia* began dedicating its weekly DX sessions as follows:

To British Isles and Europe at 1400 Sunday over VLA6, 11.76, VLC11, 15.21—June 1, British Short-Wave League, London; June 8, International Short-Wave League, London; June 15, Swedish Radio Club (SRK), Stockholm; June 22, Angliq-American Radio & Television Society, Uxbridge, England; June 29, Danish Short-Wave Club, Copenhagen; July 6, Daily Express Radio Club, Plymouth, Devonshire, England; July 13, Malmo DX Club, Malmo, Sweden; July 20, C. W. Club of Jakobstad, Jakobstad, Finland; July 27, Jonkoping-Huskvarna DX Club, Jonkoping, Sweden; August 3, Indian Radio Society, Karachi, India; August 10, Ceylon and South India Radio Club, Colombo, Ceylon.

To North America, Canada, South Africa, and New Zealand at 1920 Saturday over VLA5, 15.32, and VLC9, 17.84; and at 0025 Sunday over VLA5, 15.32, VLB8, 21.60, VLG6, 15.24, and VLC9, 17.84—June 1, *International Short-Wave Department, RADIO NEWS*; June 8, Universal Radio DX Club; June 15, Newark News Radio Club; June 22, National Radio Club; June 29, International Round Table; July 6, Grand National Short-Wave Listeners Club; July 13, New Zealand DX Radio Association; July 20, DX-ers of South Africa; July 27, New Zealand DX Club; August 3, Cleveland Radio Club (Lakewood, Ohio).

Radiotjanst (The Swedish Radio), Stockholm, broadcast a DX program to the Australian DX Radio Club on May 31 at 0030-0130 over SBP, 11.705, and SBT, 15.155, with repeat at 1700-1800 on the same day over SDB-2, 10.780, and SBT. A similar session was given for the Universal Radio DX Club on June 15 at 1100-1200, with repeat at 2100-2200, over SDB-2 and SBT.

* * *

Club Notes

Spain—The Radio Club Espanol de Santander has as current officers: D. Javier de la Fuente Quintana, presidente; D. Luis Diez Alonso, vice-presidente; D. Luis Perez Elvira, vice-presidente; D. Francisco Diez Carballo, secretario; D. Eduardo Blanco Gil, Id. tecnico; D. Jose Luis Manzanares Callejo, tesorero; D. Manuel Tortajada Iribarren, vocal; D. Juan Jose Vellido Valdora, vocal; D. Arturo Moreno Fernandez, vocal; D. Jose Ponton, vocal; and D. Francisco Bercedo Ur-

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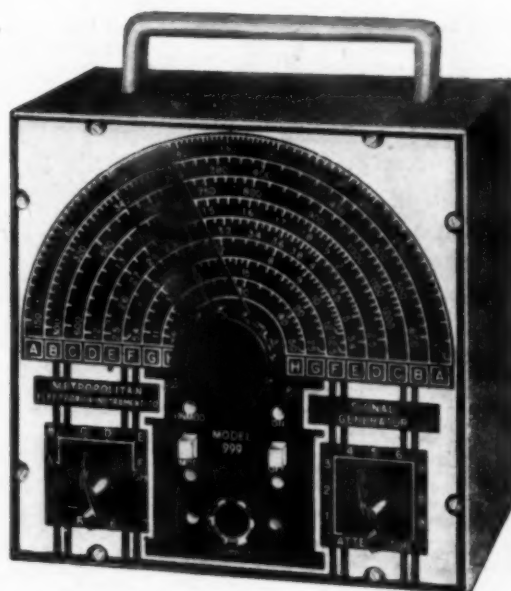
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Verification Data

Regarding the matter of verification by the BBC, we quote the following statement secured expressly for ISW Dept. readers, from H. Wilkinson, chief engineer of the BBC:

"The BBC does not verify, nor has it ever verified. . . . We hope you will appreciate our view that it is impossible for any one person to check up all the BBC short-wave transmissions sufficiently to verify reception reports. Not only would all last-minute program changes be missed by relying upon such advance information as is published, but no account can be taken of the many stations all over the world which relay BBC programs. We feel strongly that it is only at the receiving end that any verification as to the transmission to which the receiver is tuned can be assured." From this statement, it can be seen that *any* and *all* purported veries from the BBC are *unofficial and worthless*.

Nadia E. Homadka, of the Prague stations, informs me that "verifications are sent in both Czech and English; the IRC is not required, but it is advisable to send one." Address, Prague (Praha) 12.

In response to airmail reception report, *Polskie Radio* sent letter verie by registered airmail. (*All-India Radio* did the same.) Correct address of *Polskie Radio* is Noakowskiego 20, Warsaw, Poland. (Beach)

KZPI verified by letter from Henry L. Miller, production manager, KZPI, Philippine Broadcasting Corporation, 5th Floor, Filipines Building, Manila, Philippines. The British Commonwealth Occupation Forces Station, WLKS, Kure, Japan, verifies on white card, with large red call letters. (Cushen)

Paul Kary, Pennsylvania, this month furnishes the following verification information:

XORA, Shanghai, is extremely anxious to receive reports, and will "absolutely" verify all correct reports, by a card and letter; letter carries attractive letterhead with blue watermark of antenna tower and call letters and overprint of slogan, frequencies, and address; card also is a prize with verie data on one side, and Chinese flag and frequencies on the other; address, The Shanghai Broadcasting Station of the Central Broadcasting Administration, 7 Chung Cheng Road (Western), Shanghai, China. Reports to *Radio Wien*, Vienna, should be addressed to Osterr. Radioverkehrs A. G., Ravag, Argentinierstrasse 30A, Wien IV, Austria; verified by letter in German within two months. The "Voice of America in North Africa" is rather slow in verifying now; card took about four months; Miss Eileen Reis apparently is no longer with the station, card having been signed by an unidentified man's name; QRA is %
(Continued on page 126)

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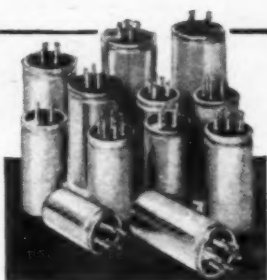
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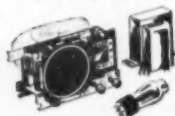


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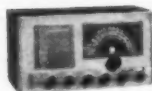
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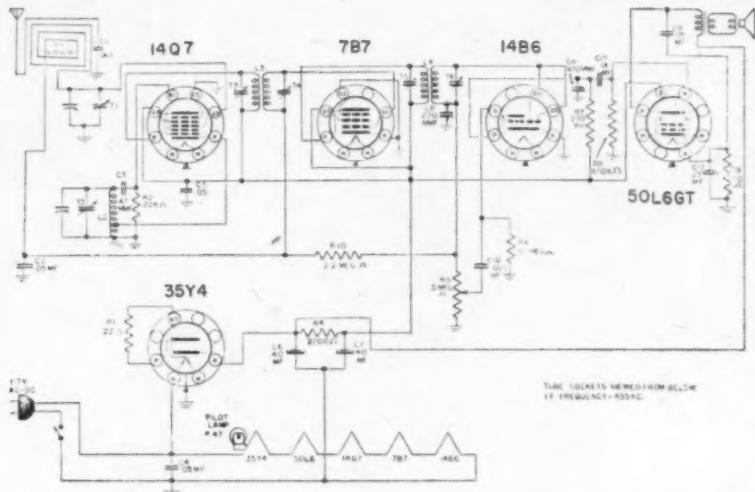


CIRCUIT PAGE

(FOR PARTS LISTS SEE PAGE 86)

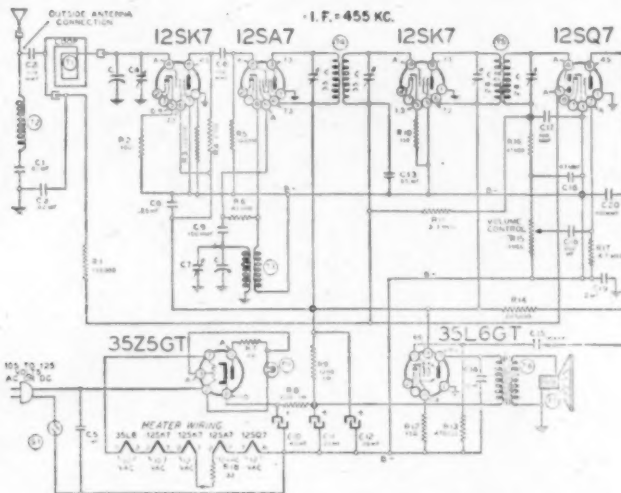
RADIO NEWS, JULY, 1947

AIR KING MODEL 4607A



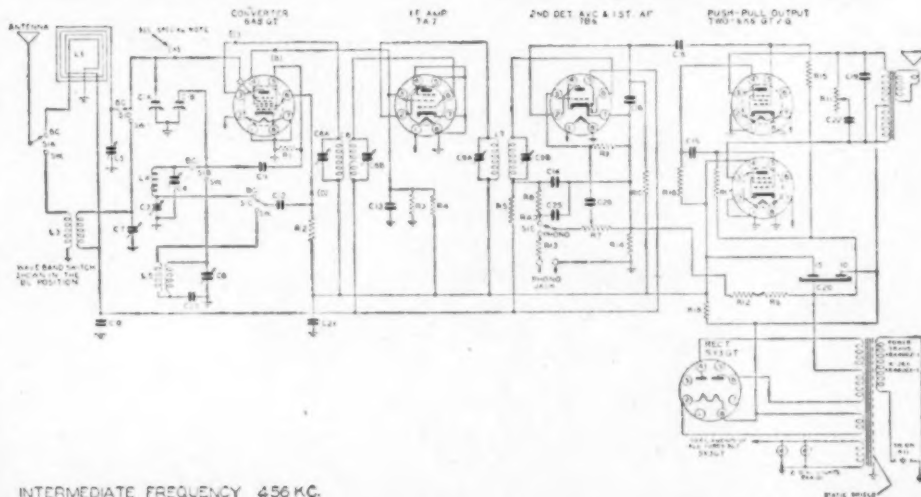
RADIO NEWS, JULY, 1947

BELMONT MODEL 6D120



RADIO NEWS, JULY, 1947

SPARTON MODELS 6-26, 6-26PA

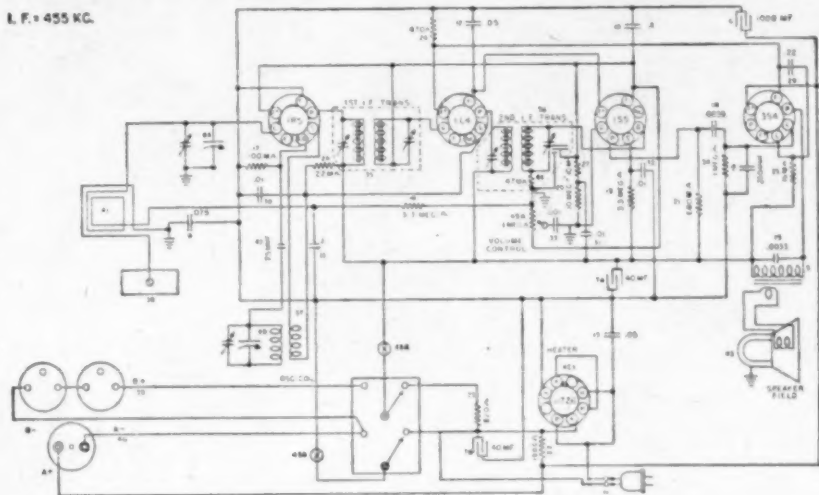


Here, and on following pages, are circuit diagrams and parts lists of many new postwar radio receivers. Radio News will bring to you other circuits as quickly as possible after we receive them from manufacturers.

RADIO NEWS, JULY, 1947

CORONET MODEL C-2

I. F. = 455 KC.



RADIO NEWS, JULY, 1947

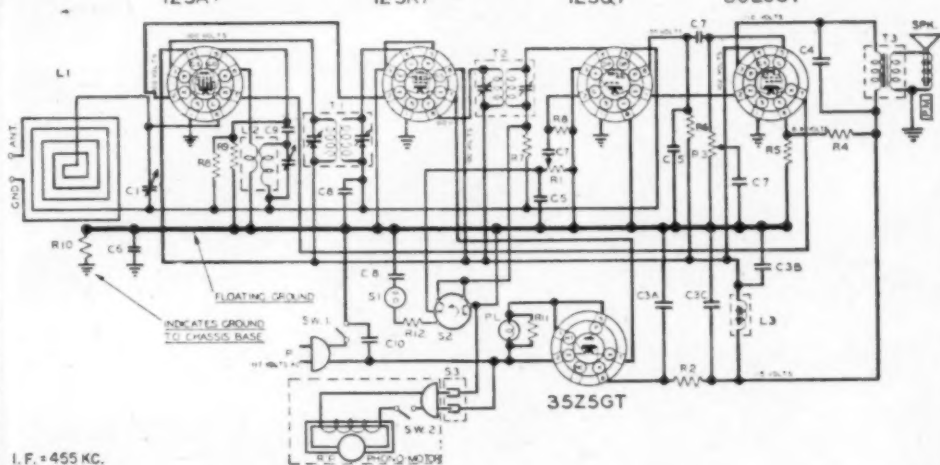
ARVIN MODEL 558

12SA7

12SK7

12SQ7

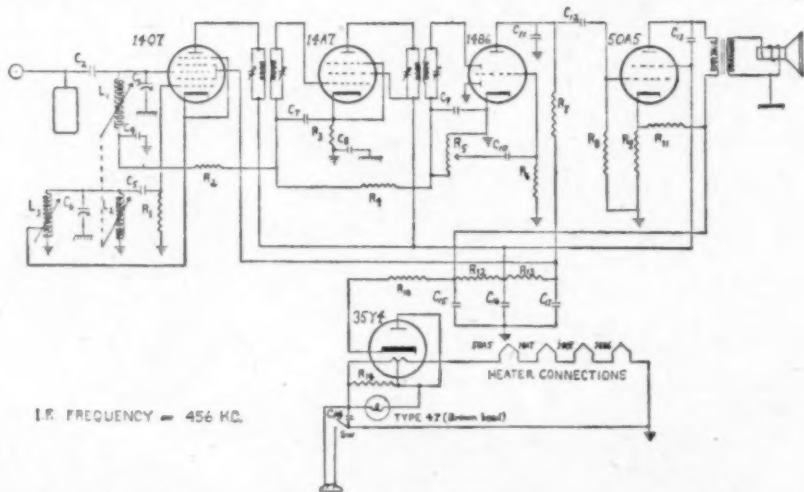
50L6GT



I. F. = 455 KC.

RADIO NEWS, JULY, 1947

CROSLEY MODELS 56PA, 56PB



I. F. FREQUENCY = 456 KC.

July, 1947

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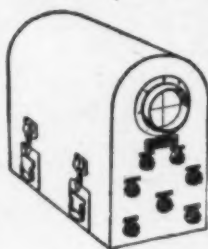
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Modified BC-412, 5" Radar Oscilloscope; ideal for first class laboratory instruments; 110V 60 cycles, complete with tubes and power supply brand new in original cartons.

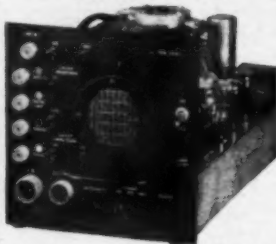
Each... \$49.95

APS-15

Has 45 tubes, one 5" scope tube, one 2" scope tube, has 3 meters, 4 power supply units 110V 400 cycles, complete with tubes.

Each \$49.50

BC-929-A



Contains power supply 110 V, 400 cycles, has 7 tubes such as 3CP1, brand new, complete with tubes.

Each... \$17.95

Used... each \$14.95

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Contains 27 tubes such as 6SN7GT, 6H6GT, 6SJ7GT, and 5CP1 scope tube; complete with tubes. Brand new in original cartons.

Each... \$24.95

Power supply and receiver for APN-4, 110V, 400 cycles.

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ARB AIRCRAFT RADIO RECEIVER

The ARB is a six tube, four band, super-heterodyne Aircraft Radio Receiver with built-in dynamotor, designed for the reception of MCW (tone or voice) or CW within the frequency range 195 Kc to 9.05 megacycles. Used... \$19.95

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Pre-amplifier model K-1, designed to raise output level of magnetic type microphone, complete with 2 tubes 6SL7GT and 28D7 and hand switch, brand new in original cartons... Each \$1.95

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Complete with tubes and crystals, freq. range 125 to 20 mc, Navy Type, excellent condition, less power supply... \$34.95

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Used in good condition, complete with tubes and calibrating crystal, freq. range 2,000 Kc to 18 mc; A-1, A-2, A-3 type transmission; power output 100 watts... Each \$75.00

RAX-1... 3 RECEIVERS

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HAND-TYPE MICROPHONE RS-38

Carbon type, with PL-68 plug, brand new... \$1.95
Used... \$1.00

MICROPHONE AND RECEIVER P-60

Dynamic type, 50-ohm impedance; mike and phones interminate in 5-wire male plugs, 3 ft. cord... \$1.49

GO-9

Navy type low and high frequency transmitter with power supply and tubes. Operates from 200 Kc to 18,100 Kc; requires 115V, 800 cycles, used, complete with tubes... \$69.50

OXYGEN MAST MICROPHONE T44C

Used with SCR-522, magnetic type, complete with JK-26. NEW. Ea. \$1.29

ANTENNA RELAY UNIT BC-442

With antenna current meter, antenna transfer relay with 3 stand-off lead-in terminals, A-1 condition. ONLY 95c

ANTENNA TRANSFER SWITCH SW-225

Triple-pole, double-throw, mounted on bakelite base with nine 2" porcelain stand-off mounts, BRAND NEW... 89c

PLUGS

PL-166; 6 light duty contacts, female, bakelite insulation... Ea. 15c
PL-Q171-6, six light duty contacts, female, right angle with bakelite insulation... Ea. 15c
PL-170; 18 light duty contacts, female, bakelite insulation... Ea. 20c

FLEXIBLE CABLE

From 92" to 250" with connectors and spline knobs... \$1.95

FILTER CHOKES All Fully Enclosed

15H. $\pm 10\%$ @ 165 MA. DC., .5 H., 60 cycles shielded, 2 stand-off terminals: size $4\frac{1}{2} \times 4 \times 3\frac{1}{2}$, each... 95c
Dual, 15H. @ 100 MA., 400 ohms DC. Each section, 500 VDC insulation test. $3\frac{1}{2} \times 3 \times 6$ High; 4 MTG. Studs and 4 terminals. Each... 79c

59H. Min. @ 107 MA.; 10V RMS 60 cycles 850 ohms DC. Res.; 4 MTG. Studs, size $4\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2}$, each... 79c
3.7 H. @ 145 MA. DC., 125 ohms DC. Res. 4 MTG. Studs, each... 95c

RED HOT SPECIALS — U. S. Government Surplus Electron Tubes

Type	Your Cost	Type	Your Cost	Type	Your Cost	Type	Your Cost	Type	Your Cost
837	\$1.85	50L6	\$4.49	77	\$4.49	50B5	\$7.79	12SL7	\$1.89
5U4	.59	6SJ7	.49	39-44	.49	1R5	.89	12BE6	.69
78	.49	12SH7	.49	12SK7	.49	1S5	.89	12BA6	.69
12A6	.69	6SS7	.49	OZ4	.69	3Q5	.89	35W4	.49
6K7	.49	6SF5	.59	6AT6	.49	6SQ7GT	.49	35L6	.59
35Z5	.54	6V6GT	.59	12AT6	.49	6K6	.59	6L6	1.29
5Y3	.43	89	.49	1N5GT	.69	6X5GT	.59	6AG7	.69

Transmitting and Special Purpose Tubes

Type	Each	Type	Each	Type	Each
12DP7 12" scope	\$6.95	5BP1 5" scope	\$3.95	3BP1 3" scope	\$2.95
9LP7 9" scope	5.95	5CP1 5" scope	3.95	829B transmitting tube	2.95
7BP7 7" scope	4.95	3AP1 3" scope	2.95	6AK5 transmitting tube	.95
5FP7 5" scope	3.95			304TH transmitting tube	7.95

VHF RECEIVER BC-701

Frequency range 170-180 Mc; IF 30.5 Mc; complete with 11 tubes; self-contained power supply; brand new in beautiful wooden carrying case... \$9.95

ASTATIC PICKUPS

With L2o crystal... Ea. \$1.79
10 for... 15.00

BC-404-C VHF RECEIVER

Frequency range 102-110 Mc; complete with 12 tubes; 110 V 60 cps, power supply included. Brand new in original cases... \$19.95

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50L5... 35c
6V6... 39c

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ARMY AIRCRAFT RECEIVER

Model
BC-946-B

Broadcast band from 520 to 1500 kc. Tube complement; 3-12SK7, 1-12SR7, 1-12A6, 1-12K8. Designed for dynamotor operation, but is easily converted to 110 or 32 volt operation. Has two I. F. stages and three gang condenser. Comes packed in sealed carton complete with tubes and instruction manual, but less dynamotor. **\$12.95**
DYNAMOTOR DM 32A. Each. **\$1.95**

RADIO RECEIVERS

BC-454-A; 3-6 mc. **\$5.95**
BC-453-A; 190-550 kc. **6.95**
BC-455-A; 6-9.1 mc. **5.95**
Used, in A-1 Condition. Complete with tubes

ARA NAVY RECEIVER

1.5 to 3 Meg. **\$6.95**
Used, in A-1 condition. Complete with 6 tubes

RADIO TRANSMITTERS

BC-457-A; 4-5.3 mc. **\$4.95**
Complete with Tubes and Crystals
BC-458-A; 5.3-7 mc. **4.95**
Complete with Tubes and Crystals

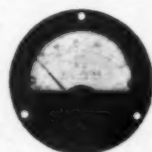
MODULATOR UNIT

BC-456-A. **\$2.95**

REMOTE CONTROL BOX

BC-450-A. **\$1.95**

ARMY SURPLUS, principal components of radio set SCR-274-N; includes 2 transmitters, 3 receivers, 1 modulator, 4 dynamotors, control box, etc.—original cost over \$600.00—NOW **\$24.95** complete.



HICKOK 2 1/2" 0-150 Volt AC VOLTMETER
Each **\$2.49**

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26 ft. of Coaxial Cable RGU8, 52 ohm, with 2 amphenol plugs, one at each end. **89c**

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Signal Corps, 8000 ohms and 200 ohms, each. **\$2.49**
2000 ohms, Trimm, each. **1.79**
EARPHONES, less headband, HS18 high impedance. **.79c**

POWER TRANSFORMER—NAVY TYPE

159 ma; 6.3 V at 6.5 amps; 5 V at 3 amps. 110 volt. **\$2.89**
200 ma; 6.3 V at 6 amps; 5 V at 3 amps. 110 V A. C. **3.50**

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For the experimenter, radio serviceman, handy man repairman, "ham," hundreds of valuable miscellaneous parts, 10 pounds. **\$1.59**

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5" PM speaker. **\$1.19**
4x6 dynamic, 450 ohms. **1.65**
5x7 PM—hvy. slug. **2.15**
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RADIO TRANSMITTER and RECEIVER APS-13

Light weight air-borne radar system, radio transmitter and receiver APS-13; tube complement: 5-6J6; 9-6AG5; 1-VR105; 2-D21; unit is brand new, complete with tubes, the tubes alone are worth more than this LOW PRICE OF ONLY....

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R-89/ARN-5

Glide Path Receiver used in the Instrument Landing System covering the frequency range 332 to 335 mc; complete with the following tubes: 7-6AJ5; 1-12SR7; 2-12SN7; 1-28D7; and including three crystals 6497KC; 6522KC; 6547KC... units are in A-1 condition for ONLY.....

SCR-522 TRANSMITTER and RECEIVER

The standard very-high frequency airborne receiver-transmitter. 100 to 156 megacycles. 4 crystal-controlled channels selected from remote control box. Used in good condition—ONLY.....

"Complete with Tubes"

RADAR OSCILLOSCOPE

Complete with 27 tubes including 5" Cathode Ray tube—used. Each. **\$24.95**

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Complete with 29 tubes including 3" Cathode Ray tube—used. Each. **\$24.95**

MARKER BEACON RECEIVER — AIRCRAFT

Complete with 2 tubes and sensitive relay to control external circuits from received signals. The receiver to control models, open doors from a distance, etc. Special. **\$4.95**



SETCHELL CARLSON RADIO RECEIVER BC-1206-C

Designed to receive A-N beam signals. 24-28 vdc 21.6 watts. Tube complement: 14H7 or 14A7, RF amplifier; 14H7 or 14J7, mixer; 14A7 or 14H7, IF amplifier; 14R7, detector and 1st audio amplifier; 28D7, output amplifier. 195 to 420 kc. 4" high x 4" wide x 6 1/2" long—wt. 3 lbs., 4 oz. Used A-1 cond. **\$4.95**



BRAND NEW in original carton **7.95**

INTERPHONE AMPLIFIER

Complete with 4 tubes **\$7.95**
Yours for only...

Comes in an aluminum cabinet 9 1/4 x 4 1/4 x 5 1/4 inches with two 12J5GT and two 12A6 tubes; also Electric Dynamotor 28DC Volt input and 250 V DC output at 60 MA.

HEAVY DUTY LINE FILTERS

Solar line filter—20 amps., 115 V. A.C., 600 V. D.C. Hermetically sealed, ideal for eliminating RF feedback in line or line noise pickup. **\$1.75**

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4 Prong Universal Vibrator **\$1.49**

Wholesalers, dealers, institutions and other quantity purchasers, write, wire, phone for quantity prices. All shipments F.O.B. Chicago. 20% deposit required on all orders.

DEPT. C

\$15.00

\$9.95

\$19.95

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Counts number of feet of trailing wire antennae; number turns when winding on coil; applicable for many uses; beautiful bakelite case, jeweled dialite, pilot light enclosed, 3 position switch, counts up to 1000. Each. **.95c**



BATTERY FOR "GE" PORTABLES

2 volt Willard type 27/2 the exact replacement in Pre-War Model LB 530 "GE" Portable Radios Plastic case, size 3 1/4 x 3 1/4 x 5 1/4" high. Shipped dry Uses standard battery electrolyte. List value \$8.75. **BRAND NEW! Your Cost. \$1.95**

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Multiple circuit telephone type key switch; available in momentary or locked position. Double pole, double throw. Each. **.89c**

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PL55 plugs. **each 20c**
PL68 plugs. **each 20c**
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No. 449. **100 for \$4.90**

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50-30, 150 volt electrolytic tubular. **\$0.39**
100 assorted, tubular, all 600 volt, .01, .02, .03, .1. **6.95**
100 assorted mica. **1.95**
So ar 8-8 @ 450 WV inverted type in alum. can. **69c**

RESISTORS

100 assorted 1/2 and 1 watt. **\$1.95**
100 assorted 5 and 10 watt. **6.95**

VOLUME CONTROLS

10 assorted volume controls, less switch. **\$1.75**
1/2 Meg. with witch 2" shaft. **each 49c**
10 for **\$3.95**

IF TRANSFORMER

456 kc, matched sets. **.79c**

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SPST push-to-make switch. **\$0.19**
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CARDWELL-XE-240-XS: 30-240 MMF variable .100 airgap Mycalex insulation. \$2.95

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BUD 250 MMF split stator variable .051 airgap Isolantite insulation. 2.95

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Each complete with instructions

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OHMITE—50 watt 20 ohm adjustable resistor. 15c each 10 for..... 1.25

GENERAL RADIO 433A Potentiometers 100,000 ohms, wire wound 6" diameter. 1.95

BC 406 RECEIVER, 15 tubes, tunes 195-207Mc; 110 volt, 60 cycle. Suitable for conversion to 2 meters or Television. Special \$15.95

BC 645 TRANS RE-CEIVER, 420-450Mc; 460-490Mc; complete with tubes and W.E. 316A doorknob and conversion diagrams. Brand New \$14.95

Oil Filled Condensers	All Standard Brands
10 MFD 600v DC \$.98	0.1 MFD 7500v DC \$1.50
2 MFD 1000v DC .79	0.02 MFD 8000v DC .98
10 MFD 1500v DC 3.50	2 MFD 10000v DC 17.50
2 MFD 2000v DC 1.75	16 MFD 400v DC .92
4 MFD 4000v DC 5.95	7 MFD 330v AC 1.25

HEINEMAN CIRCUIT BREAKERS—Magnetic type in 5-20-35-65 amp. sizes. Special \$0.95

BULLS EYE Pilot assembly; 110v AC Candelabra base; 1 inch Jewel U-L approved50

BUSSMAN FUSES type 8AG; 1/100 amp; suitable for meter protection. Per doz.50

SELSYNS — Type 5 synco transmitter, used in pairs as transmitter and follower. 110v AC. Per pair \$5.00	SELSYNS — Indicator type in armored case; No. 11-1 110v AC. Per pair \$9.00
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METER BUYS

0-1 MA 2"	McClintock	\$2.45
0-1 MA 3"	General Electric	3.50
0-1 amp. R.F. 2"	General Electric	2.45
0-30v AC 3"	Westinghouse	2.45
500-0-500 Microamps 4"	Western Elec.	3.75

NEONS — While they last.	CONTROL BOX for 522 Transceiver—consists of 5 push button switches, 5 W. E. Copilot lite assemblies & lever switch, all mounted in box. Brand New \$1.25
2 W Edison base. \$0.29	
¼ W Screw & Bay base20	
1/25 W Bay base & wire leads... .08	

SCHWEIN—Free and Rate Gyro. Operates from 24 volts DC; complete in metal case ready for use. Special..... \$5.00

TWIN LEAD, 300 ohm cable 100 ft.... 2.95
COAXIAL CABLE 52 ~ RG/80 100 ft. 4.25

If not rated 25% with order, balance C.O.D. All prices F.O.B. our warehouse New York. No order under \$2.00

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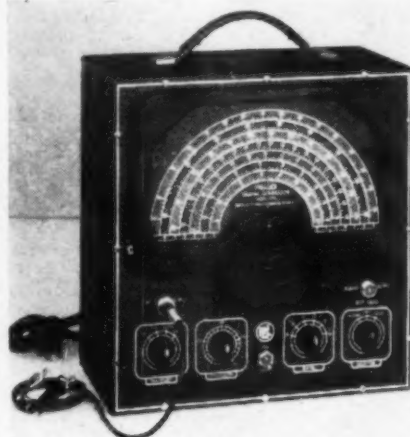
75 Vesey St., Dept. RNJ
Cortland 7-2612 New York City 7

What's New in Radio

SIGNAL GENERATOR

Premier Electronic Laboratories of New York have recently announced their new Model No. 570 precision tuning signal generator which incorporates several unique features.

One of the special features is the "Micromaster" precision dial which



contains spring-loaded split gears to eliminate backlash and provide split-cycle tuning. Frequency range of this unit is from 75 kc. to 50 mc. on fundamentals and up to 150 mc. on the third harmonic. Air trimmers are used on all bands. According to the company, calibration is accurate to .5% up to 1.6 mc. and 1% on higher frequencies.

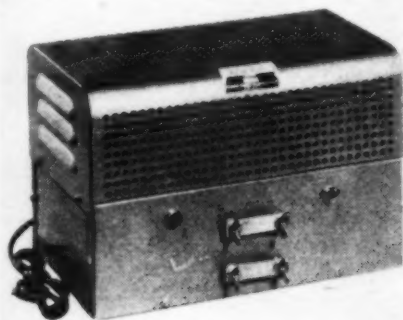
The buffer stage is modulated by an internal 400 cycle generator providing pure sine wave modulation (less than 5% distortion) as well as an audio signal for external testing purposes. The instrument can also be modulated by an external audio oscillator.

Complete details will be furnished by Premier Electronic Laboratories, 382 Lafayette Street, New York 3, New York upon request.

POWER SUPPLY UNIT

The new Model A Power Supply Unit has recently been added to the line of equipment manufactured by Electro Products Laboratories, Inc. of Chicago.

Designed especially for use by serv-



icemen who specialize in auto, marine, and aircraft radio servicing, the Model A incorporates large sized transformer, chokes, rectifiers and filter con-

densers and provides negligible hum and high instantaneous power output.

This unit consists of two 6 volt, 7.5 ampere filtered d.c. power sources which can be placed in parallel for 15 ampere continuous service or in series for 12 volt, 7.5 ampere continuous service.

The power supply unit weighs 31 pounds and operates from any 105, 115, or 125 volt, 60 cycle source.

Electro Products Laboratories, Inc., 549 West Randolph Street, Chicago 6, Illinois will supply additional details upon request.

MARINE SPEAKERS

Four types of loudspeakers which have been especially designed for the severe operational requirements of marine and railway installations have been announced by University Loudspeakers, Inc. of New York.

The four types, coded MIS, MIL, MM-2 and MM-2F, feature reflex air columns and built-in hermetically sealed driver units. The speakers are immune to dust, dirt or live steam, according to the manufacturer.

Operational details and further information on this line of speakers will



be furnished by University Loudspeakers, Inc. to those who write direct to the company at 225 Varick Street, New York, New York.

CAPACITOR ANALYZER

Solar Manufacturing Corporation of New York City has recently announced production on a new, small, lightweight capacitor analyzer.

The instrument is a revised version of the Solar Model CB with improved elements for use in humid climates. The new Solar Model CBB has an extended capacitance range to measure capacitors from 10 µfd. to 800 µfd. The unit, which has a Magic Eye tube for Wien bridge balance indication, may also be used as a line frequency resistance bridge covering a range of 50 ohms to 2 megohms. For visual

THE NEW **MEISSNER** RADIO - PHONO - RECORDER

A Four-Way Performer



- A VERSATILE RECORDER
- A HIGH FIDELITY RECORD PLAYER
- A SENSITIVE, SELECTIVE RADIO RECEIVER
- AN AUXILIARY P.A. AMPLIFIER

Here is the combination you've been waiting for and the outstanding entertainment value of the year. A four-way performer, the new Meissner Radio-Phono-Recorder combines the functions of a versatile home recorder, a high quality, high-fidelity record player; a sensitive seven-tube super heterodyne radio receiver and a low power public address system . . . all in one unit that easily surpasses anything now being offered. Compact in design, precision-built and easy to operate, this super combination is now available at your jobber's. See it today or write for full information to the address below;

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THE MEISSNER

RADIO-PHONO-RECORDER

A Versatile Recorder. For faithful reproduction of all radio programs or "live" talent. Crystal cutting head makes perfect records up to 10" in diameter. Crystal microphone. 2 turntable speeds for recording and playback.

High Fidelity Record Player. For playback of home recordings or commercial discs up to 12". Featherweight crystal pick-up arms. Ample storage space in lid for blanks.

Sensitive Superheterodyne Receiver. 6 Tubes Plus Rectifier. A sensitive, selective radio receiver built in for direct program recording without room noise. Both radio programs and "live" talent may be blended simultaneously on one record.

Public Address Amplifier. For "announcing" to small groups. Ideal for school & church use. May be connected to external speaker for greater volume.

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20% DOWN—12 MONTHLY PAYMENTS!

Yes, Your Credit is Good at NEWARK! Now you can buy all the wonderful new equipment you want—Receivers... Transmitters... Test Equipment... Sound Systems... Parts... and hundreds of other items... for only a Small Down Payment! Yes, take ONE YEAR TO PAY the balance on our convenient Low Cost Plan. The only carrying charge, is 6% of the unpaid balance. No More!

It's so simple! So easy! Here's how the plan works: Choose any equipment totalling \$75 or more from our tremendous stock of standard lines... Pay only 20% down... The balance in 12 Easy Monthly Installments. For example: If you choose a \$125.00 item, pay only \$25

LIBERAL TRADE-IN ALLOWANCE—You'll like Newark's Fair-Deal Policy—A liberal trade-in allowance on your present equipment toward the purchase of any new unit. Write us—or drop in at any of our convenient stores in New York or Chicago to discuss the details.

down, leaving a balance of \$100, plus only \$6.00 carrying charge. Then pay \$8.84 per month for 12 months. That's all!

Don't wait! Enjoy that new rig! USE IT NOW... PAY LATER! Get those Parts or Test Equipment, or whatever you need NOW... and Pay while you use it! Take advantage of NEWARK'S Convenient Time Payment Plan TODAY!

We are AUTHORIZED DISTRIBUTORS of ALL STANDARD MAKES of RADIO and ELECTRONIC EQUIPMENT. Look at the partial list (Below) of New Equipment NOW IN STOCK—All available Now on Convenient Time Payments:

RECEIVERS • TRANSMITTERS • P. A. EQUIPMENT • TEST EQUIPMENT • RADIO, ELECTRONIC & TELEVISION COMPONENTS

SOME OF HUNDREDS OF ITEMS AVAILABLE ON TIME PAYMENTS

RECEIVERS			
NATIONAL			
Description	Price	Down	Per Mo.
NC-173T, With Speaker	\$189.50	\$37.94	\$13.39
NC2-40-DT, With Speaker	241.44	48.36	17.06
NC-46, With Speaker	107.40	21.48	7.59
HRO-5TA1, w/Pow. Supply	697.294.71	59.03	20.82
HALLICRAFTERS			
S-40A, Receiver	89.50	17.90	6.32
SX-42, With R42 Speaker	304.50	60.90	21.52
SP-44, Panoramic Adapter	99.50	19.94	7.03
HAMMARLUND			
SPC-400X, w/Speaker in Cab.	347.25	69.45	24.54
HQ-129X, w/Speaker in Cab.	173.25	34.65	12.24
R. M. E.			
UHF-152, Hi. Freq. Conv.	86.60	17.36	6.11
RME-84, Complete	98.70	19.74	6.97
RME-45, Complete	198.70	39.70	14.04
COLLINS			
75A-1, Receiver	530.00	106.04	37.44
TRANSMITTERS			
COLLINS			
30K1, Transmitter	1825.00	365.00	128.96
32V1, Transmitter	590.00	118.04	41.69
HALLICRAFTERS			
HT9, 100 Watt Transmitter	289.50	57.94	20.49
TEMPCO			
75GA, 75 Watt Transmitter	495.00	99.00	34.98
500GA, 500 Watt Transmitter	1500.00	300.00	106.00
JOHN MECK			
AF-100, 100 W. Xmtr. Comp.	450.00	90.00	31.80
T60-1, 60 Watt Transmitter	150.00	30.00	10.60
SONAR			
VFX-680, All Band Exciter	87.45	17.49	6.17

TEST-EQUIPMENT			
R. C. A.			
Description	Price	Down	Per Mo.
155-C, 3" Oscilloscope	115.00	23.00	8.11
160-B, 3" Oscilloscope	185.00	37.04	13.07
162-C, Channalyst	162.50	32.54	11.48
WV-75A, Voltchymyst	125.00	25.04	8.83
WA54A, Audio Oscillator	152.50	30.58	10.77
SUPREME			
546A, 3" Oscilloscope	87.95	17.63	6.21
561, Oscillator	135.87	26.63	9.46
HICKOK			
191X, Mil. Volt Generator	145.92	29.28	10.30
305, Oscilloscope & Oscil.	145.50	29.10	10.28
288X, Signal Generator	159.06	31.86	11.23
534, Tube & Set Tester	138.30	27.66	9.77
JACKSON			
652, Audio Oscillator	117.00	23.40	8.27
WESTON			
798, Tube Check. & Analyzer	187.09	37.45	13.22
785, Circuit Tester	103.59	20.79	7.32
TRIPLETT			
2432, Signal Generator	86.73	17.37	6.13
1632, Signal Generator	107.80	21.64	7.61
PRECISION			
954P, Port. Tube & Set Tester	97.22	19.46	6.87
DUMONT			
164E, 3" Oscilloscope	185.00	37.00	13.42
208B, 3" Oscilloscope	235.00	47.00	16.69
274, 5" Oscilloscope	115.50	23.10	8.16
SIMPSON			
330, Tube Tester	96.53	19.37	6.81
415, Signal Generator	112.70	22.58	7.96

\$5 Deposit with Your Order Now Will Reserve Your Equipment

Prices Subject to Change

NEW YORK
 Offices & Warehouse
 242 W. 55th St., N.Y. 19

NEWARK
ELECTRIC COMPANY, INC.

CHICAGO
 323 W. Madison St.
 Chicago 6, Ill.

New York City Stores: 115-17 W. 45th St. & 212 Fulton St.

checks of the insulation resistance of electrostatic capacitors and the leakage current of electrolytic capacitors, simplified neon lamp test circuits are used.

Complete details on this instrument may be obtained from the *Solar Manufacturing Corporation*, 285 Madison Ave., New York 17, N. Y.

POCKET-SIZED OHMMETER

A new and inexpensive pocket-sized ohmmeter for spot checking radio and electronic circuit components, automobile horns, relays, generators, starters, electric clocks and other electrical equipment has been announced by the Radio Tube Division of *Sylvania Electric Products Inc.* of New York.

The instrument which has been particularly designed for the radio serviceman will indicate transient or other faults in difficult replacements including i.f. transformers, tuning units and



audio sections; approximate values of individual resistors; and open or shorted conditions in other circuit components.

The ohmmeter is enclosed in a tubular plastic case $\frac{3}{8}$ " in diameter and $5\frac{1}{4}$ " over-all. The prod tip base and top cap, constructed of green molded bakelite, are mounted in the transparent cellulose acetate tube housing the meter.

Direct readings between 0 and 10,000 ohms are given on a 1.5 ma. full scale sensitive Weston meter in series with and a standard penlight dry cell. Test electrodes include a stainless steel prod built into the meter case and one secured to the tip of a 17 inch test cord.

Sylvania Electric Products Inc., 500 Fifth Avenue, New York 18, New York will supply additional data upon request.

FLOCK SPRAY KITS

General Cement Manufacturing Company of Rockford, Illinois has recently introduced a new kit for the application of flock to phono turntables, cabinets, grilles, instrument cases, tool boxes, etc.

Featuring a new patented blower spray gun for flock, this unit is capable of distributing the flock evenly and blows each fibre into the undercoat vertically with great power. Coats of varied softness and density can be obtained by the amount applied.

The company emphasizes that no (Continued on page 123)

IT'S NEW



THE HI-PAR
 Non-Directional FM Antenna

HI-PAR PRODUCTS CO. FITCHBURG MASSACHUSETTS

NON-DIRECTIONAL

Efficiently receives signals from any direction. Eliminates faults of dipoles yet costs no more. Exclusive Matching Section provides maximum gain. Modern styling. Permanent construction. The antenna that meets all present and future requirements.

Patent Pending

SOME AREAS OPEN TO REPRESENTATIVES

TELEVISION-

America's Next Giant Industry?



Billboard Announcing Telecasts of Ball Games in Chicago

Today, RIGHT NOW, clear and bright pictures of great sports events, as well as other equally interesting programs, are being telecast for the enjoyment of thousands. Television stations in New York, Chicago, Philadelphia, Washington, Detroit, St. Louis and Los Angeles are already operating on regular schedules. Construction has started in several other centers and it is believed that practically every major city in the country will have this wonderful service before the end of 1948.

Who will build, maintain, and operate the new telecast stations? Who will design, produce, install and service the receivers?

Men Must Be Trained for These New Professions

Alert young men with an ambition to grow with television are training now in the greatly enlarged instruction laboratories of American Television, Inc. A wide choice of courses available. Advanced methods and latest obtainable equipment used.

One of Our New Buildings.
Air Conditioned the Year Round.



July, 1947



U. A. Sanabria

Dr. Lee deForest

The Men Who Direct American Television

The instructional quality of training is under the constant personal supervision of two internationally known engineers, Mr. U. A. Sanabria, President and Founder of American Television, Inc. and Dr. Lee deForest, the famed inventor of the radio tube.



FREE PRE-ENTRANCE COURSE

A Short Home Study Television Course is available to qualified war veterans who are considering residence training. This course is free of any charge or obligation. Your success with it will help you to learn your own abilities in television. It will also aid us greatly in qualifying you for residence training. Your acceptance of the Home Study course in no way obligates you to enter our residence school. So we urge you to take advantage at once of the very unusual opportunity it offers.



Approved for Veteran Training Under G. I. Bill of Rights

American Television, Inc.

5050 BROADWAY

CHICAGO 40, ILLINOIS

REQUEST FOR FREE INFORMATION

American Television, Inc., Dept. of Information
5050 Broadway, Chicago 40, Illinois

Please send details of your Television Training.

NAME _____

ADDRESS _____

CITY _____

ZONE _____

STATE _____

☐ I am a veteran

RADIOMEN'S HEADQUARTERS WORLD WIDE MAIL ORDER SERVICE!!!

SERVICEMEN

Check This Column for Lowest Prices on Quality Parts

TUBES: A warehouse full, including the new miniatures. Order all the types you need and we will try to supply you completely. The following prices are for fifty or more assorted tubes. 5% less in lots of 100 or more. 27, 5Y3—38c; 28, 35Z5, 56, 75—44c; 76, 78, 6J5—50c; 6SK7, 6NQ7, 12SA7, 12SQ7, 5U4, 6C6, 6D6, 6SA7—54c; 6SJ7, 12SJ7, 5Y4, 5Z3, 6K9, 6K7, 6V6, 6BD7—60c; 6J7, 6K8, 6SF7, 72c; 5Y4, 6ET, 12BA6, 12AT6—88c; 6L6—99c; 32T7—\$1.00; 50B5—\$1.25. These special prices on tubes are for one month only.

POWER TRANSFORMERS—Half-shell type, 110V 60 cy. Centertapped HV winding. Specify either 2.5 or 6.3 filament when ordering.

For 4-5 tube sets—650V, 40MA, 5V & 2.5 or 6.3V.... \$1.49
For 5-6 tube sets—650V, 45MA, 5V & 2.5 or 6.3V.... 1.75
For 6-7 tube sets—675V, 50MA, 5V & 2.5 or 6.3V.... 1.90
For 7-8 tube sets—700V, 50MA, 5V & 6.3 or two 2.5.... 2.35
For 9-11 tube sets—700V, 100MA, 5V & 6.3 or two 2.5V.... 2.85
For 9-15 tube sets—600V, 150MA, 5V & 6.3V.... 2.95

TRANSFORMERS—All types in stock. **AUTO-TRANSFORMERS:** Steps up 110v to 220v, or steps down 220v to 110v—\$1.95. **FIL. TRANS.**: 6.3v, 8 Amps.—\$1.98; 5v, 10 Amps.—\$1.98; Universal Output Trans. 8 Watt—89c; 18 Watt—\$1.29; 30 Watt—\$1.69. **AUDIO TRANSFORMERS:** B. Plate to S. Grid 3:1—79c; C. Plate to P.T. Grids—79c; Heavy Duty Class AB or B. P.F. Inputs—\$1.49; Midset Output for AC-DC sets—69c. **MIKE TRANSFORMER** for T-17 Shure microphone similar to UTC oncure type—\$2.00.

CONDENSERS—PAPER TUBULAR 600 WV. .001; .002; .005—8c; .01; .05—9c; .1—10c; .25—23c; .5—36c; **ELECTROLYTICS:** 5mf 200v—20c; 10mf 35v—20c; 30mf 150v—23c; 20/20mf 150—35c; 30/20 150v—46c; 50mf 150v—43c; 8mf 475v—34c; 16mf 350v—65c; **OIL CONDENSERS:** 4mf 600v—49c; **BATH TUB TYPE CONDENSERS:** 3X.1mf—20c. **RESISTORS.** All types in stock at the lowest prices; Resistor Kits—100 2 watt resistors—\$1.95.

FILTER CHOKES: 200, 300, 400, 500 ohm light duty—59c; 200 or 300 ohm heavy duty—99c; 250 ma 35 ohm, made for U.S. Navy, fully shielded—\$1.95; 75 ohm 125 ma—25c or 25 for \$4.25; "Meissner type" tapped filter chokes—25c; 8 amp. iron core A filter—25c; Choke-condenser combination. Ideal to replace any size speaker field when installing I'M speakers—79c.

110 V. CIRCUIT BREAKERS of Magnetic type: Following Current Ratings in Stock: 1.25, 3, 4, 8 Amps. Please Specify. \$1.95 each. Seven Assorted I.F. Transformers—\$1.98; Five Assd. Oscillator Coils—69c.

WILLARD rechargeable 2 volt storage batteries for G.E. portable radios—\$2.95. **SPEAKERS—PM dynamic type—4"**—\$1.55; 5"—\$1.55; 6"—\$1.95; 8"—\$3.95; 10"—\$5.95; 12"—\$7.50. **PHONO-MOTORS**—110V, 60 Cycle, with turntable—\$4.25.

HEADPHONES—Highest quality Signal Corps headsets with sponge rubber ear cushions. 12" cord and plug \$1.25. 5" rubber covered patchords with phone plug & socket—45c.

RELAYS—Guardian SPST 12-24v. has heavy duty 15 Amp. Contacts—\$1.25; Guardian 12 to 24v D.C. triple make, single break relay, 5 for \$3.75; Sigma supersensitive 2000 ohm D.C. SPDT Relay. (May be adjusted to operate on less than 1 Milliampere)—\$2.50; 6 Pole, Double Throw, Telephone Type 2000 ohm Relays, Super Sensitive, \$2.50 ea., or two for \$4.50.

SELENIUM RECTIFIERS—Dry diode type 1 1/2" by 1 1/2" Amp. maximum, suitable for converting DC relays to AC for supplying filament source in portable radios, converting DC meters to AC applications, and also may be used in low current chargers—90c.

METER RECTIFIERS—Full wave, may be used for replacement, or in construction of all types of test equipment—\$1.25. Half Wave—90c.

LINE FILTERS—110V—each unit contains two 2 mfd. oil filled condensers and a 16 amp. iron core choke. This filter has innumerable uses such as oil burner line filter, etc. A ten dollar value for 99c.

CRYSTAL PICK-UP, phone motor and turntable—\$5.25. **PUBLIC ADDRESS AMPLIFIERS**—25 Watts peak output, 5 tubes, separate controls for Microphone and Phono Inputs. \$65.00 value for only \$32.00.

Wire—No. 18 POSJ 2 conductor parallel sipecord, brown, 250 ft. spools—\$4.25; 500 ft. spools—\$7.95; No. 18 PD brown rayon covered parallel lampcord, 500 ft. spools—\$7.95; No. 18 SV round rubber covered double wire for wash machines, vacuum cleaners, etc. 250 ft. spools—\$5.95; Rubber covered mike cable—6c per foot; RG8U 50 ohm coax cut to any length—8c per foot. Single stranded conductor shielded lead with brown rubber over shield, super special, \$1.20 per 100 ft.; \$10.00 per 1000 ft. All kinds of hook-up wire—1c per foot.



MICROPHONES—All nationally known brands. Bullet crystal—\$3.48; Bullet Dynamic—\$7.48; Mike Jr.—40c; Handy Mike—90c; Laurel Mike—93c; **SHURE T-17 MIKES**, with push to talk switch—99c. **20 ASSTD COIL FORMS**, including 11 ceramic, 3 polystyrene, and 6 fiber, all useful sizes—50c. **VARIABLE CONDENSERS:** 350 MMFD, 5 gang—\$1.95; 4 gang—\$1.49; 3 gang—83c; 2 gang—75c; 7.5 to 20 MMFD, 1750v spacing, extra long shaft Ham-mund—69c; miniature variable—25 MMFD—39c; 50 MMFD—49c; 75 MMFD—59c; 100 MMFD—69c; 140 MMFD—79c. **TRANSMITTING RF CHOKES**, 4 1/2" 350 Ma.—25c or 5 for \$1.00. **INTERRUPTION FREQUENCY COILS** for super-regenerative receivers or for tremendously condenser FM adapters for standard broadcast sets. Iron core with a resonant frequency 50 KC—39c; Air Core, 100 KC—29c. **30 MC IF TRANSFORMERS**, double slug tuned—28c. **VIDEO PLATE COILS**—Slug Tuned—25c. **REMOTE CONTROL UNIT:** Aluminum case 4x3x2" containing 2 potentiometers, triple pole switch, 4 knobs, gear mechanism, counter and phone jacks—59c. **MODULATION TRANSFORMERS:** 10 watt, metal case—98c; 30 watt, open type—\$1.95; 40 watt, cast aluminum case—\$2.95; Class "B" input transformers, cast aluminum case—\$1.95; Transceiver and amplifier transformers—69c; Transceiver modulation transformers—69c.

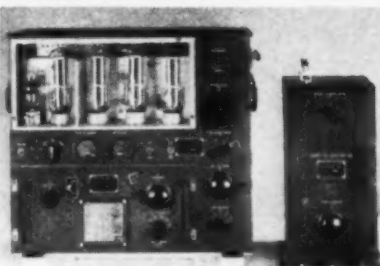
Minimum order \$3.00—All prices subject to change.—25% deposit with C.O.D. orders

6-BAND COMMUNICATIONS RECEIVER BC-348

Featuring coverage from 200 to 500 Kc. and 1500 to 18000 Kc. on a direct reading dial with the finest vernier drive to be found on any radio at any price—high sensitivity with a high degree of stability—crystal filter—BFO with pitch control—standard 6 volt tubes. Contains a plate supply dynamotor in compartment within the handsome black crackle finish cabinet, the removal of which leaves plenty of room for installation of a 110V, 25 or 60 cycle power supply. These receivers, which make any civilian communications receiver priced under \$200.00 look cheap and shabby by comparison, are only \$44.50. Power supply kit for conversion to 110V, 25 or 60 cycle, is only \$8.50 additional.

ARMY BC 312 COMMUNICATIONS RECEIVER

This receiver covers the frequency range of 1.5 MC to 18 MC in six direct reading bands. The dial, that is driven with split gears to prevent backlash, has 4500 logging divisions per band with approximately 600 divisions on the 20 and 40 meter ham bands and 1000 divisions on 80 meters. Two stages of RF before the converter in this set give it a very high signal to noise ratio and maximum sensitivity. Outstanding features of this receiver are: BFO with pitch control, send-receiver relay, jacks on the front panel for headphones and speaker output and mike and key input, all tubes are standard 6 volt types. This receiver was designed to withstand rough usage in the field and for operation from vehicles while in motion, so it is ruggedly constructed and contains a dynamotor power supply.—Your cost \$49.95. Conversion kit 110 VAC is available for \$6.50.



GENERAL ELECTRIC 150-WATT TRANSMITTER

Cost the Government \$1800.00
Cost to you \$44.50!!!

This is the famous transmitter used in U. S. Army bombers and ground stations, during the war. Its design and construction have been proved in service, under all kinds of conditions, all over the world. The entire frequency range is covered by means of plug-in tuning units which are included. Each tuning unit has its own oscillator and power amplifier coils and condensers, and antenna tuning circuits—all designed to operate at top efficiency within its particular frequency range. Transmitter and accessories are finished in black crackle, and the milliammeter, voltmeter, and RF ammeter are mounted on the front panel. Here are the specifications: **FREQUENCY RANGE:** 200 to 500 KC and 1500 to 12,500 KC. (Will operate on 10 and 20 meter band with slight modification.) **OSCILLATOR:** Self-excited, thermo compensated, and hand calibrated. **POWER AMPLIFIER:** Neutralized class "C" stage, using 211 tube, and equipped with antenna coupling circuit which matches practically any length antenna. **MODULATOR:** Class "B"—uses two 211 tubes. **POWER SUPPLY:** Supplied complete with dynamotor which furnishes 1000V at 350 MA. Complete instructions are furnished to operate set from 110V AC. **SIZE:** 21 1/2 x 23 x 9 1/4 inches. Total shipping weight 200 lbs., complete with all tubes, dynamotor power supply, five tuning units, antenna tuning unit and the essential plugs. These units have been removed from unused aircraft and are guaranteed to be in perfect condition.

BC-947A ONE KILOWATT HIGH FREQUENCY TRANSMITTER

This relay-controlled transmitter includes a 115V, 60 cycle power supply, protected by 3 magnetic circuit breakers, that alone is worth more than the price we are asking for the whole rig, even on today's surplus market. On the front panel are six 3 1/2" GE or Weston meters, including 250 MA, 50 MA, 1000 MA, 150V AC, and 1500V DC at 1000 ohms per volt for screens and plate. The rack-type 21"x15"x36" unit contains six amplifier and rectifier tubes aggregating over \$60.00 at WAA current wholesale prices. Western Electric's price to the government was \$1500.00. Shipping weight 500 lbs. Your cost, as is, only \$69.95.

GENERAL ELECTRIC RT-1248 15-TUBE TRANSMITTER-RECEIVER

TERRIFIC POWER—(20 watts) on any two instantly selected, easily pre-adjusted frequencies from 435 to 500 Mc. Transmitter uses 5 tubes including a Western Electric 316 A as final. Receiver uses 10 tubes including 955's, as first detector and oscillator, and 3 7H7's as IF's, with 4 slug-tuned 40 Mc. IF transformers, plus a 7H7, 7E6's and 7F7's. In addition unit contains 8 relays designed to operate any sort of external equipment when actuated by a received signal from a similar set elsewhere. Originally designed for 12 volt operation, power supply is not included, as it is a cinch for any amateur to connect this unit for 110V AC, using any supply capable of 400V DC at 135 MA. The ideal unit for use in mobile or stationary service in the Citizen's Radio Telephone Band where no license is necessary. Instructions and diagrams supplied for running the RT-1248 transmitter on either code or voice, in AM or FM transmission or reception, for use as a mobile public address system, as an 80 to 110 Mc. FM broadcast receiver, as a Facsimile transmitter or receiver, as an amateur television transmitter or receiver, for remote control relay hook-ups, for Geiger-Mueller counter applications. It sells for only \$29.95 or two for \$53.90. If desired for marine or mobile use, the dynamotor which will work on either 12 or 24V DC and supply all power for the set, is only \$15.00 additional.

RADAR INTERCONNECTOR UNIT, contains 15 tubes—\$29.95. **C-144 TRANSMITTER**, 2 type 826 tubes as oscillator in lecher line tuning circuit that resonates between 150 and 200 Mc. Contains 3 DC power supplies that operate from 110v 60 cycles, 10 tubes, meter, circuit breaker, and carrying case—\$49.95.

AIRCRAFT AMPLIFIER C1—This unit is housed in an aluminum case that is 9x8x7 inches and contains 1-7Y4, 3-7N7, 3-7P7 and six 5000 ohm sensitive relays. This unit is brand new and in its original packing—\$9.95.

BC-654 TRANSMITTER-RECEIVER—Brand NEW with 17 tubes, key, microphone and calibrating crystal—\$39.95.

BUFFALO RADIO SUPPLY, 219-221 Genesee St., Dept. 7N, BUFFALO 3, N. Y.
CABLE ADDRESS BUFRAD

RADIOMEN'S HEADQUARTERS 世界 WORLD WIDE MAIL ORDER SERVICE!!!

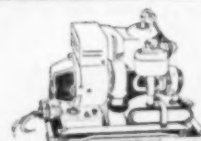
ELECTRONIC ALTIMETER ONLY \$75.00

BRAND NEW APN 1 14-tube electronic altimeter in original packing cases. This famous 18x9x7 unit, which weighs only 25 pounds, without plugs or cables, cost the government \$2000, and includes a transmitter, a receiver, all tubes, an altitude limit switch, and two easily installed 11" antennas. A 28 volt dynamotor is included which can be easily changed to other aircraft supply voltages. Working on the radar principle the receiver measures the absolute altitude from 3 ft. to 4000 ft. with precision enough for blind landings. In addition the altitude limit switch gives an alarm if the plane's height varies more than 10 feet from a preadjusted value. Another outstanding feature is that connections are provided to control an electronic automatic pilot. This unit might also be used to warn boats of any obstruction that is on their course.



PE-109 32-VOLT DIRECT CURRENT POWER PLANT

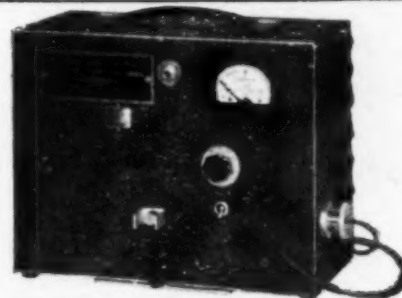
This power plant consists of a gasoline engine that is direct coupled to a 2000 watt 32 volt DC generator. This unit is ideal for use in locations that are not serviced by commercial power or to run many of the surplus items that require 28-32 V. D.C. for operation. The price of this power plant is only \$100. We can also supply a converter that will supply 110v AC from the above unit or from any 28-32v DC source for \$29.95.



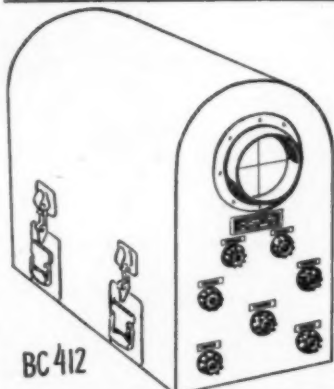
AT LAST YOU CAN AFFORD A LABORATORY STANDARD SIGNAL GENERATOR

The famous Measurements Corp. Model 78B, 5 Tube Laboratory Standard Signal Generator (currently selling new, FOB Boonton, N. J., for \$310.00 net), is available in perfect condition for 25 to 60 cycle, 115 V AC operation. Until now this is the sort of top-flight lab equipment that discriminating buyers have only vainly hoped would be released at a bargain price. Worth every cent the manufacturer asks, but available FOB Buffalo while our limited supply lasts, for only \$99.95.

"REMEMBER THAT A STANDARD IS ONLY AS RELIABLE AS ITS MAKER."



Model 78-B Standard Signal Generator. Two Frequency Bands between 15 and 250 megacycles.



LORAN INDICATOR OSCILLOSCOPE, complete with 26 tubes and a 5" cathode ray tube—\$39.95.

5" RADAR OSCILLOSCOPE BC-412, these units are easily converted to first class laboratory instruments by a few hours work. 110v. 60 cps.—\$59.95.

5" SO RADAR PPI OSCILLOSCOPE complete with 9 tubes. This unit contains magnetic deflection yokes and a selsyn motor—\$39.95. SO RADAR ECHO BOXES, THE PERFECT CALIBRATED CAVITY WAVEMETER—\$10.00.

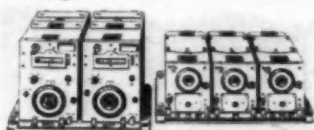
RADAR RANGE UNIT contains a three stage high gain, high fidelity, amplifier and a Helmholtz coil for manually introducing phase shift of 0° to 360°. Contains four tubes and a 110v. 60 cps. power supply.

MC 363A RANGE CONVERTER containing 20 tubes, servo motor, oscillator, motor field amplifier, isolating amplifier with three stages, 3 stage summing amplifier, 2 stage preamplifier, control amplifier including band shaping motor supply network to improve servo motor operation, and high current, regulated power supply, similar in construction to the well-known RA57A power unit. Govt. cost \$2000—only—\$39.95.

SCR625 MINE DETECTOR. Weighs 15 lbs. and detects metallic objects only. Brand New—\$39.95.

SCR610 VOICE TRANSMITTER-RECEIVER ready to operate 10 meter mobile with the addition of a crystal of the proper frequency.—only \$49.95.

BENDIX SCR 522—Very High Frequency Voice Transmitter-Receiver—100 to 156 MC. This job was good enough for the Joint Command to make it standard equipment in everything that flew, even though each set cost the Gov't. \$2500.00. Crystal Controlled and Amplitude Modulated—HIGH TRANSMITTER OUTPUT and 3 Microvolt Receiver Sensitivity gave good communication up to 180 miles at high altitudes. Receiver has ten tubes and transmitter has seven tubes, including two 832's. Furnished complete with 17 tubes, remote control unit, dynamotor and Ant.—\$37.95. Furnished complete with 17 tubes, remote control unit, 4 crystals, 24 volt dynamotor and the special, wide band VHF antenna that was designed for this set. These sets have been removed from unused aircraft and are guaranteed to be in perfect condition. We include free parts and diagrams for the conversion to continuously variable frequency coverage in the receiver. The cost of this unit is only \$37.95. A brand new 12 V. 522 dynamotor is available for \$3.00 additional, with the purchase of a 522, or separately for \$15.00.



SCR-274N COMMAND SET

The greatest radio equipment value in history.

A mountain of valuable equipment that includes 3 receivers covering 130 to 550 KC; 3 to 6 MC; and 6 to 9.1 MC. These receivers use plug-in coils, and consequently can be changed to any frequencies desired without conversion. Also included are two Tuning Control Boxes; 1 Antenna Coupling Box; four 28 V. Dynamotors (easily converted to 110 V. operation); two 40-Watt Transmitters including crystals covering 3 to 4 MC and 4 to 5.3 MC; and Preamplifier and Modulator. 29 tubes supplied in all. Only a limited quantity available, so get your order in fast. Removed from unused aircraft, and in guaranteed electrical condition. A super value at \$29.95, including crank type tuning knobs for receivers.

Minimum order \$3.00 - - - All prices subject to change - - - 25% deposit with C.O.D. orders

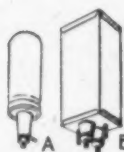
BUFFALO RADIO SUPPLY, 219-221 Genesee St., Dept. 7N, BUFFALO 3, N. Y.
CABLE ADDRESS BUFRAD



OIL-FILLED XMTG CONDENSERS

Made by well-known manufacturers. All fully guaranteed. Never before offered at these sensationally low prices!

Cap. Mfd	D.C.W.V.	Your Cost
.1-.05-.25	600	\$0.59
4	600	.59
2	1000	.69
10	1000	1.29
15	1000	1.98
10	1500	1.49
3	2000	.98



ROUND CAN "A" .1 mfd-3000 V. oil-filled, ideal for television **\$0.59**
SQUARE CAN "B" 4 mfd-400 V. oil filled general purpose filter **\$0.59**

SQUARE CAN "B" .1 mfd 7500 volts, single terminal, can ground. **\$1.98**

OIL-FILLED HERMETICALLY SEALED BAYTUB CONDENSERS



Ideal for tricky circuits calling for highly stable, reliable condenser. Made by nationally known mfr. Don't miss this terrific buy! Fully guaranteed.

Cap. Mfd.	Voltage	Cap. Mfd.	Voltage
.05	200	1.0	400
.05-.05-.05	200	.05	600
.3	400	.5	600
.5	400	1.0	600
.1-.1-.1	400		

Your Choice, Any Assortment **TEN FOR .98**



Compact Rectangular Can OIL-FILLED CONDENSERS

.25 mfd-600 V. .05 mfd-1000 V.
.05-.05 mfd-1000 V.
Your Choice, **TEN FOR 98c**

ROUND ALUMINUM CAN Replacement Electrolytics

Ideal replacement for those good old sets still in use.

8-8 mfd 450 V. 8-16 mfd 450 V.
8-8-8 mfd 450 V. 9-9-18 mfd 450 V.

YOUR CHOICE . . . **49c each**

ACORN TUBES

Types 954, 955 **TEN FOR \$2.90**

Lo-Loss Sockets for Acorn Tubes. Ten for **\$2.90**
RA-20 POWER PACKS—still a few left. **\$9.95**
3-gang 365 mfd Variable Tuning Condenser with trimmers. **\$1.59**

Mail Orders: 25% Deposit, Balance C.O.D. Minimum Order \$5.00.

Federated Purchaser
INCORPORATED
distributors of **RADIO-ELECTRONIC**
and **SOUND EQUIPMENT**
808 PARK PLACE, N. Y. 7
Phone: WH 4-2080

SHOWMANSHIP SELLS MERCHANDISE

By **ZENN KAUFMAN**

Get away from the straight and narrow path of time-worn merchandising ideas—try out new techniques.

GEORGE M. COHAN, master playwright and producer, used to say that if you didn't have your audience guessing at the end of the first act then your show wasn't worth a plugged nickel! Cohan's judgment made him a rich man, so let's see if we can't use his formula in the radio business.

Mystery books sell big. Any witch's tale will always pull radio audiences. Mystery pictures pack movie houses. Your public loves mystery. Object lesson—give it to folks in your sales promotion. Smart merchandisers do. At the World's Fair people stood in line for an hour at the Continental Can Company booth to punch a button that would manufacture a tin bank worth a nickel! Inquiry developed the fact that two out of every four people in the line didn't even know what they were waiting for.

In direct mail or newspaper advertising a bit of mystery can help. Jack Smith, the mail order expert, once told a radio dealers' convention that over 40% of all advertising envelopes were thrown away unopened. Isn't this simply a challenge to us to put something on the envelopes that will excite enough interest to guarantee a reading?

Crime pays. At least it pays when you use it as a theme for selling goods. Mystery shows like "Suspense" and "Inner Sanctum" have huge audiences. The public is always interested in a mystery thriller. So you can easily see why it pays to put a mystery angle into your merchandise. A touch of suspense can help make your next sales contest successful. RCA reports phenomenal success with a clerks' contest based on a poker game. Clerks were given one card blind from a deck for each sale made. At the end of the week a prize was given to (a) the salesperson holding the most cards, and (b) the person holding the best poker hand. This contest can be staged to push any item or combination of items.

The Minnesota Power & Light Company based a contest on a G-Man theme—a "Search For Missing Sales," in which each salesman was given a quota of sales to find. A chart on the wall carried a string of blank footprints next to his name, and as he "captured" the missing customers, his trail of footprints was colored in

red. The first salesman to get to the end of the trail got the prize. This contest was successful because every man is at heart an amateur Hawkshaw. If you scratch the average citizen, you usually uncover a man who is—secretly—an amateur sleuth.

Fred Maytag developed a washer contest based on a "Kidnapping" theme. Salesmen received scribbled messages reading: "You have been picked to do the job. Them that squeals gets croaked!" After this mystery percolated for a few days, the men received an announcement to the effect that a campaign was being run on certain items and they were to "kidnap" as many prospects as possible. Of course, the story went on to tell that the "swag" would be divided among the men doing the best "kidnapping" job.

Quiz programs on the air show that even education can be made exciting if wrapped in the sugar coating of suspense. "Information Please," "Take It Or Leave It," and hundreds of other quiz shows attract audiences of millions weekly.

The quiz technique is good for training clerks, too. Try this "Cranium Cracker" plan sometime. Give your men a list of 20 statements about various items in the store. Tell the men that 10 of the statements are right, 10 are wrong. You'll find that Carrie Clerk or Sammy Salesman will get a real kick out of trying to spot the answers.

George Graf has introduced mystery to sales meetings by using a "Voice of Experience" speaking over a concealed microphone. At one point in the meeting the sales manager says that the next feature of the program is not ready, during which time a radio will be turned on. Then out of this radio comes a special sales story fed through a concealed microphone. The "Voice of Experience" introduces himself on the air and reads a letter from a clerk asking how to handle a certain difficult sales situation. The "Voice" then proceeds to answer the question. This unusual way of presenting training material will double or triple its effectiveness.

Salesmen at the Lazarus store in Wilkes-Barre would wear label tags reading "gonna" when doing outside work. When queried, the salesmen explained "Yes, you told me you were

STANCOR

really has something
to meet your servicing needs



POWER PACK . . . Model 752

The Model 752 power pack provides a well filtered 6 volt—12.5 ampere D.C. supply from any standard 115 volt, 60 cycle source. Replacing messy and troublesome storage batteries for numerous types of service it is ideal for automobile radio sales demonstration or service test bench, effectively operating most push button tuning auto sets. Useful apparatus for industrial or laboratory testing. Best all purpose low voltage pack. All controls, knobs, voltmeter and terminals are visible and accessible on plainly marked escutcheon panel. Pack may also be used for auto accessories testing, battery charging, magnetic field exciting, electroplating, etc.

FOR DEMONSTRATING AND SERVICING

AUTO RADIOS AND
OTHER AUTO
ACCESSORIES

BATTERY CHARGING

OPERATING RELAYS
AND SOLENOIDS

REPLACING STORAGE
BATTERIES

LABORATORY
TESTING

BRUSH PLATING

ask your jobber for the **STANCOR 752**

STANDARD TRANSFORMER CORPORATION
ELSTON, KEDZIE AND ADDISON • CHICAGO, ILLINOIS



QUALITY TELEVISION KIT MADE BY PIONEER MANUFACTURER!

This easy-to-assemble high quality television kit is being made into top-notch receivers — thousands are thrilling video fans everywhere!

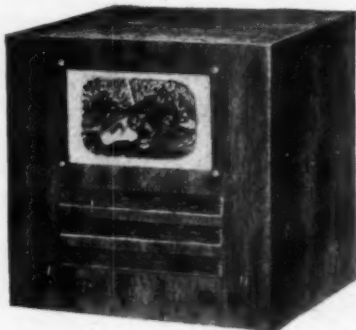
This kit has been designed and planned for rapid assembly by advanced electronics engineers. Complete schematic and instructions with each unit.

**KIT DELIVERED COMPLETE
WITH FRONT PANEL AT ONLY**

\$149⁵⁰

with cabinet \$40 extra

(20% deposit required on all orders.
Balance C.O.D.)



YOUR QUALITY TELEVISION KIT IS DELIVERED TO YOU COMPLETE INCLUDING —

- Specially designed antenna.
- 7-inch cathode ray tube.
- Pre-tuned R-F stage.
- Finished front panel (grilled speaker and a 35 sq. in. mask for picture.)
- Specially designed 35 sq. in. mask for cathode ray tube, giving larger picture.
- All solder, wire, and 60 ft. of low loss lead-in cable.

KIT INCLUDES SOUND AND ALL COMPONENT PARTS

Operates on 110 V.

50-60 Cycles A.C.

**MAIL
COUPON
TODAY!**

MELODY MFG. CORP.
68 Lexington Avenue
Franklin Square, Long Island, N. Y.
Enclosed find \$.....deposit. Please ship.....
Television Kits C.O.D. to:
Name.....
Address.....
City.....Zone...State.....

Get Ready for Summer BATTERY BUSINESS



Distributors for BURGESS and RAY-O-VAC

Send for FREE replacement guide and stock up from our complete line of portable and AB batteries and packs.

Write for FREE Buying Guide

U.S.R.S.
U. S. RADIO SUPPLY
5116 HARPER AVENUE
CHICAGO 15, ILLINOIS
DEPT. NE7

'going' to buy a refrigerator. When you buy it I switch to this 'Gotta' button."

In personal selling, too, a bit of suspense can be profitable. John Jones, when selling washers in Texas, would walk into a woman's house and ask to use the telephone. While the woman listened Paul called his office and reported the sale of a "unit" and ordered them to rush another "unit" to him at a nearby street corner. Seldom could the woman resist the temptation to ask what "unit" might be. That, of course, was Paul's invitation to make his sales pitch.

Don't Go Too Far

Mystery excursions are another expression of the public's craving for the unknown. The "New Yorker" tells about a man who lived 140 miles from Washington, drove in one morning to take a "mystery" excursion. Train went back to his home town. (Can you imagine the expression on his face, that night, when his friends asked him where the train had gone?) He was disgusted, naturally—didn't want to return to Washington, but had to get his car and drive another 140 miles back. This rather nicely illustrates a warning about mystery in general. Don't go too far in teasing your public. If your public feels cheated, you are worse off than before you started.

With mystery pulling so strongly, it is only reasonable to ask why it is not used more. Ah! That's another mystery!

(Acknowledgement is made to Harper Brothers for permission to reprint parts of "Showmanship in Business" by Goode and Kaufman.)

-30-

UNUSED AERIAL LINKS

MANY small radios have a built-in aerial loop which is ordinarily all the aerial required.

However, some such sets have links provided so that an external aerial wire may be used.

The screws holding these links may loosen and intermittently open the antenna circuit — causing fading and noise.

Keep the screws holding these links tight by going over them with the screwdriver as shown . . . H.L.



RADIO NEWS

Everybody refers to the RADIONIC Catalog!

FREE



**...BECAUSE IT'S ONE, COMPLETE,
COMPREHENSIVE, RELIABLE VOLUME**

From border to border and coast to coast, from Singapore to Saskatchewan, RADIONIC answers the need for parts and equipment of every conceivable type—delivered at high speed for rock-bottom prices.

The best description of RADIONIC EQUIPMENT COMPANY is; "A well staffed ORGANIZATION, thoroughly equipped to purchase everywhere, any time, all types of radio parts and equipment and deliver them to customers INTERNATIONALLY at unbelievably low prices . . . And, with full technical assistance, consultation and service."

In other words, we are not just another business. Ours is an intelligent combination of hard-hitting, service-minded, sincere, experienced men and

women whose guiding purpose is your satisfaction. Our customers are our friends. MORE THAN THAT, they are our partners in this steadily growing enterprise which owes its success to results produced.

Do not fail to send today for this RADIONIC CATALOG offered absolutely free. It will save you many hours of purchasing time and BEST OF ALL, even more DOLLARS IN THE BARGAIN. Every bit of merchandise we sell is guaranteed, backed by our international reputation for fair dealing.

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RADIOS • TEST INSTRUMENTS • TELEVISION COMPONENTS • INTERCOMMUNICATORS • RECORDERS • PUBLIC ADDRESS • TUBES • HARDWARE • RECORD CHANGERS • TECHNICAL BOOKS • PARTS AND ACCESSORIES

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Radionic Equipment Co., Dept. 57
170 Nassau St., N. Y. 7, N. Y.
Gentlemen:

Please send your Free Catalog No. 47, listing products of leading manufacturers of radio electronic parts and equipment; also, all literature c's published.

Name.....

Street.....P.O. Box.....

Town.....Zone.....

State.....



5-TUBE AC-DC SUPERHET KIT \$9.95! PERSONAL PORTABLE KIT \$10.95

EVERY KIT COMPLETE - NOTHING ELSE TO BUY - ORDER NOW

BEAUTIFUL PLASTIC KIT \$9.95

Kit Model P-85. We have finally been able to achieve our goal. Here it is. A good 5-tube broadcast AC DC superhet radio receiver for less than ten dollars. The beautiful 10 inch plastic cabinet is made of the finest material. The chassis is of the standard accepted superhet design. 456 KC ifc AVC and 5 inch Alnico 5 PM speaker. Attractive vernier dial. Two gang tuning condenser. Loop ant. We defy anyone to offer a better working AC DC receiver kit. Priced complete with diagram, photos and tubes 12K8, 12SK7, 12SQ7, 50L6 and 35Z5. Nothing else to buy. You can't go wrong on this value. Kit Model P-85Net \$9.95



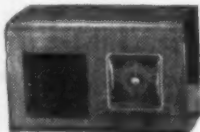
DELUXE PLASTIC CABINET AC-DC SUPERHET KIT. Cabinet size 7x6 1/2 x 10 1/2". Attractive slide rule dial. 2-gang tuning condenser. Receives broadcast 550 to 1650 KC. Has latest Alnico 5 PM speaker. Loop antenna; all parts simplified diagram and tubes 12SA7, 12SK7, 12SQ7, 50L6 and 35Z5 furnished. Kit P-48. Wt. 9 lbs.Net \$12.95
4 TUBE 1 1/2-90 VOLT FARM RADIO KIT. Offered in same cabinet as the above Kit Model P-48. The same high gain broadcast superhet circuit. Complete with 4 tubes; 1R5, 1T4, 1B5, 354 and diagram. Less battery pack. Kit model PB-48.Your Cost \$10.95



DELUXE AC-DC KIT J-D5
 Beautiful walnut cabinet and all the parts to build a broadcast 5 tube AC-DC radio. Superhet with slide rule dial. 2 gang tuning condenser and loop aerial. Everything furnished; includes speaker and tubes 12SA7, 12SK7, 12SQ7, 35Z5 and 50L6 and diagram.Net \$14.95
Kit J-D5. Wt. 10 lbs.Net \$14.95
Kit K-50. Similar cabinet to above J-D5 except it is AC Trans. type and has 6 volt tubes.Net \$16.95



Kit K-7A. Easily assembled into a fine working, attractive, transformer type AC broadcast receiver; 550 to 1700 KC. Has push-pull audio, tone control and 6 1/2" Alnico 5 PM speaker. Beautifully made 14" walnut cabinet. Incorporates a standard superhet circuit, with AVC and loop antenna. All parts, schematic and tubes 6SA7, 6SK7, 6H6, 6SN7, 2-6G6's and 5Y3 furnished. Nothing else to buy. Wt. 17 lbs.Net \$19.95



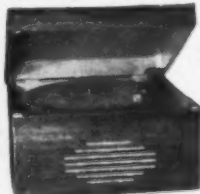
20-WATT UTILITY AMP. KIT, \$17.95

Build this 20 watt utility 110 volt AC, 20 Watt power amplifier. Ready punched aluminum chassis, size 12 x 6 x 2 1/2 inches. Has two input circuits, one mike and one phono. Mike stage has 135 DB gain, for crystal or dynamic mikes. Has bass and treble controls. Designed for use with PM speakers; has 8-16 ohm output transformer. All parts, controls, transformers and easy-to-follow diagram furnished, including tubes: 2-6SN7, 6J5, 2-6L6GA, 5Z3. Kit Model 20-LA. Net.....\$17.95
 12" 15 watt Alnico 5 PM speaker, \$6.95 extra. Astatic crystal mike and desk stand, \$7.95 extra.



WALNUT CABINET RECORD PLAYER \$16.95

Beautifully made, highly polished walnut cabinet with hinged lid. Plays 10" records with lid closed. Latest rim drive phono motor and high output. Astatic crystal pick-up. High power 3 tube AC-DC phono amplifier (wired and tested). Heavy duty 4" Alnico 5 PM Speaker. Single record player kit.Net \$16.95

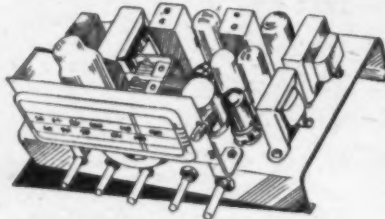


SMALL RADIO-PHONO KIT, \$22.95

After carefully designing the record player and cabinet shown above (Model WL-3), we decided that it should also be offered as a radio-phono combination. The cabinet is both attractive and small (12x12x8). The radio kit part of this unit is similar, except for the dial, to our Kit Model K-PT shown in column 1 of this page. We furnish all parts, tubes, phono motor, pick-up, etc. Easy to follow diagram. Kit Model WL-3R. Wt. 16 lbs.Net \$22.95

ORDER WITH CONFIDENCE. NO FULL C.O.D.'S. SEND AT LEAST A 20% DEPOSIT. INCLUDE POSTAGE ON SMALL ORDERS.

8-TUBE RADIO AMP. KIT \$29.95



Build this High-Fi Radio Amplifier

- Beautiful 8" Slide Rule Dial.
- Standard Superhet Circuit covering Broadcast 550 to 1700 K.C.
- 2-Gang Tuning Condenser.
- Offered with 12 or 15 in. PM Speakers. Push-pull 6V5 Output stage giving 18 watts of full range audio.
- Dual Tone Controls (Bass and Treble).
- Inputs for both Mike and Phono pick-up.

Here is something new in radio. A real 15 watt power amplifier with bass and treble controls. Has extra gain stage for crystal or dynamic mikes. And on the same chassis, a standard superhet radio receiver. We furnish all parts, knobs, escutcheon plate and tubes: 6SA7, 6SK7, 6SR7, 6SN7, 6SJ7, two 6V4 and 5Y3. No cabinet. Extra care in designing the power supply section assures low hum level, making this unit ideal for recording as well as P.A. use. We furnish everything as well as schematic diagram and photos of the completed chassis. Weight 35 lbs. PRK-10 Radio Amp. Kit with 12 P.M. Speaker.....Net \$29.95
 PRK-10X Radio Amp. Kit with 15 in. \$30.00 value Cinnnaudograph P.M. speaker.....Net \$42.95
 If you desire a more powerful Audio section in the above kit we offer either the PRK-10 or PRK-10X with a full 200 mill power transformer and push pull 6L6 tubes in the final giving 25 watts of full range audio for \$10.00 extra on either kit.

DELUXE REC. CHASSIS \$22.95

Deluxe broadcast receiver chassis kit model AB-4 this kit is offered those who want a good receiver to install in their cabinet. The design is of the accepted type; standard superhet. Has power transformer push-pull 6V5 output tubes; tone control; 2 gang condenser and 8 inch deluxe slide rule dial; similar in appearance to our PRK-10 kit; shown above; except it has no provision for mike. Offered with a 12 1/2" 15 watt Alnico 5 PM speaker. Priced complete with diagrams, photos and tubes 6SA7, 6SK7, 6SR7, 6SN7, 2 6V6 and 5Y3. Kit Model AB-4.....Net \$22.95

PORTABLE RADIO RECORDER KIT \$49.95

RADIO RECORDER KIT MODEL G-30. Here is the last word in kits. We furnish you everything to make this attractive good working radio and recorder. Has a beautiful alligator covered portable case. General Industries 12445 78 RPM recording play back mechanism. The 8 tube superhet receiver and power amplifier is all on one chassis. With this unit you can record directly for your popular radio station or from any crystal or dynamic mike. Push pull output tubes assures good recordings and the best in tone quality. Furnished complete with easy to follow diagram. Photos and tubes 12SA7, 12SK7, 12SQ7, 12SL7 and two 35L6. Dry disc, rectifier. Heavy duty 6 in. Alnico 5 PM speaker. Priced complete nothing else to buy.Net \$49.95
 Kit model G-30.....Net \$49.95
 Crystal mike with desk stand \$6.95 extra.



G.I. RECORDER MECHANISMS

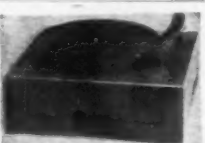
Latest 1947 General Industries recording assemblies with 4 ohm magnetic cutters and crystal play back
 Model 12445-78 RPM. Net.....\$24.50
 Model 13700-35 and 78 RPM. Net.....28.95
 Model 13810-Automatic changer with cutter, 78 RPM. Net.....40.10

MUSICAL

AMP-KIT, \$22.95
 Build this 10 watt AC-DC musical amplifier. Designed with the new selenium rectifier in a unique voltage doubler circuit. Has gain stage for crystal or dynamic mike and inputs for instrument or phono pick-up. Variable tone control. Priced complete with 12" speaker and case as shown and tubes 2-50L6, 12SL7, 12SJ7. All parts, rectifiers and punched chassis and wiring diagram furnished.Net \$22.95
 Kit Model MM-10.....Net \$22.95
 Crystal Mike and desk stand.....\$7.95 extra

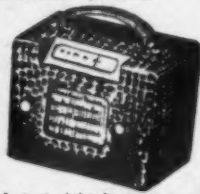


Kit J-19 SINGLE RECORD ATTACHMENT. Attractive walnut finished base with motor cut out, latest 78 RPM rim drive phono motor and light weight, high output crystal pick-up. Easily attached to any radio or amplifier. Kit J-19 Dealers.....Net \$7.95 complete
 Model B-4 phono oscillator (fits under base). Dealers.....\$3.69
 Scoop Phono Meter & Xtal Pickups.....\$4.99



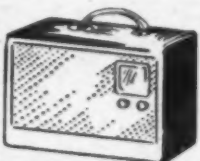
PERSONAL PORTABLE \$10.95

PERSONAL PORTABLE KIT MODEL K-PX. Small size leatherette covered case 8x6x1. Easy to build. Operates on self contained B and A batteries. Rec. Broadcast 550 to 1600 K.C. Incorporates a standard superhet circuit with AVC. Has 3 inch Alnico 5 PM speaker. Priced complete with batteries, pictorial diagram and tubes 1R5, 1B5, 1T4 and 354. Not AC DC, but straight battery operated. Has 2 gang cond. everyone should have one of these personal portables. Kit K-PXnet \$10.95



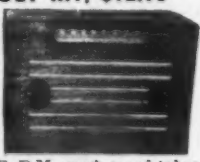
3-WAY PORTABLE RADIO KIT, \$17.95

Build this powerful, 4-tube, 3-way portable kit. Operates on 110 volts AC or DC or self contained batteries. Receives broadcast 550 to 1650 K.C. Incorporates a standard superhet circuit with AVC and loop Ant. Has Alnico 5 PM Speaker, 2 gang condenser. All Parts and batteries are furnished including tubes Disc Rectifier, 1R5, 1T4, 1B5 and 354. Has attractive leatherette portable cabinet size 7x9x9. Weight 14 lbs. Kit model 3-2ANet \$17.95



NEW SUPER MIDGET KIT, \$12.95

MODEL KP-T
 Build this new super Midget Broadcast Radio. Has beautifully made, highly polished walnut cabinet. Size 7 1/2 x 4 1/2 x 5 1/2. Attractive slide rule dial. Incorporates a standard superhet circuit with 456 KC IFS & AVC. Has 2 gang condenser and loop ant. Every part including Alnico V. P.M. speaker and tubes. 12BE6, 12BA6, 12AT6, 50B5 & 35W4. Furnished as well as photo and easy to follow diagram. Weight 5 lbs.



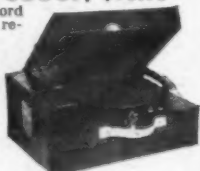
RADIO-PHONO COMB. KIT, \$24.95

Build this beautiful portable combination radio phonograph. We furnish everything. Beautiful two tone portable case, latest rim drive phono motor, Astatic crystal pick-up. All parts to build high quality 5 tube AC-DC radio. Tuning broadcast, 550 to 1650 KC. Has tone control, loop antenna, 6" Alnico 5 PM speaker. Tubes 12SA7, 12SK7, 12SQ7, 50L6 and 35Z5. Simple diagram furnished. Kit Model RP-12. Wt. 20 lbs.Your Cost \$24.95



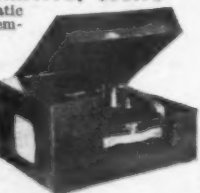
RECORD PLAYER SCOOP, \$16.95

Assemble this single record player. Only a few minutes required to mount pick up, motor and ready wired and tested amplifier. Everything furnished including tubes 12SR7, 50L6 and 35Z5. Has heavy duty Alnico V PM speaker, tone and volume controls. Has latest crystal pick up and 78 RPM phono motor. The attractive Alligator covered case is small and ruggedly constructed. (15x6 1/2 x 11.) This is our leader in a portable record player. Weight 18 lbs. Kit J-20. Net.....\$16.95



PORTABLE AUTOMATIC, \$33.95

Kit J-24 Portable Automatic Record Player. Easily assembled in a few minutes. Has beautiful Alligator covered portable case. Latest single post record changer and ready wired and tested powerful push pull AC DC amplifier. Furnished with the latest type crystal pick up which drives the pushpull 35L6 tubes to full output with exceptional base and treble response. Furnished with tubes Two 35L6 and 35Z5. Has full 6 1/2" Alnico V PM speaker, tone and volume controls. Kit J-24 priced complete nothing else to buy. Net.....\$33.95



RECORD PLAYER KIT, \$11.95

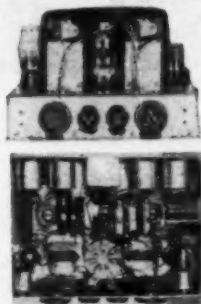
Only 300 of these top quality single record player kits to sell at this exceptionally low price. Has latest 78 RPM rim drive phono motor and light weight crystal pick up. Ready wired and tested 3 tube AC DC amplifier and Alnico V PM speaker. Has separate tone and volume controls. Easily assembled in a few minutes. Priced complete with tubes 12SR7, 50L6 and 35Z5. Kit Model J25. Net.....\$11.95



McGEE RADIO COMPANY WRITE FOR CATALOG SEND 20% DEPOSIT—BALANCE C.O.D. 1225 McGEE ST., KANSAS CITY, MISSOURI

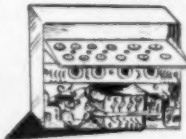
ARMY PARTS SALVAGE SCOOP!—\$2.49 EACH TWO FOR \$4.49

Another red hot value in salvage. All kinds of good useable parts in this unit. Con. Res. Relays, Modulation trans, and tubes VR150, 12J5 and 1625. Brand new and in factory carton. Originally designed to modulate the BC 457 W.E. Transmitter. You can find many uses for this. BC-456 Modulator scoop, price.....\$2.49



BOTTOM VIEW

G.E. SERVO-AMP. SALVAGE \$1.95 Each, Two for \$3.50



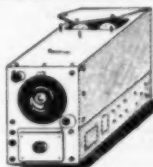
General Electric Salvage Scoop. 12 tube servo amplifier. Loads of transformers oil filled condensers, neon lamps, volume controls, etc. The octal tube sockets in this unit are worth more than the sale price. You can salvage many useable parts from this unit. Only a few hundred to sell. Weight 20 lbs. Priced less tubes. Net \$1.95. Two for.....\$3.50

SCOOP—NEW 3 TO 6 MC.

Aircraft Rec. has 1415 kc. I.F. channel. Easy to convert to a hot 10 meter receiver.

\$2.95 Less Tubes

\$5.95 With Tubes



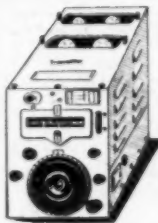
The Army Aircraft Receiver BC-454 covers 3 to 6 MC. Has 3 gang tuning condenser and two stages of 1415 KC. Intermediate frequency. By removing plates from the gang and re-winding the Ant. R.F. and osc. coils you can have a red hot 10 meter receiver. We have plenty of these in the original factory carton. Priced less the 28 volt dynamotor.

New BC-454 3 to 6 MC. Rec. less tubes.....Net **\$2.95**
With 12K8 three 12SK7, 12SR7, 12A6.....Net **5.95**
New BC-455 6 to 9 MC. Rec. less tubes.....Net **2.95**
With six tubes.....Net **5.95**
28 volt snap on dynamotor for either rec.....**.95**
Used but guaranteed. BC-454 or BC-455 with all 6 tubes **\$3.95** each.

AIRCRAFT TRANSMITTERS

BC-457-A—4 to 5.5 MC BC-458-A—5.3 to 7 MC

This really fits the ham's dream. Ideal for a 55 watt transmitter with 575 volts at 250 MA plate supply, or VFO to drive a high power rig. It's a companion unit to the 451-455-453 series aircraft receivers. Made by Western Electric and really rugged. The oscillator will hold the frequency, even under rough operating conditions. Has 12J5 M. O. and 2-1625 (807) in parallel as final P. A. or buffer to feed into a high power rig. Built in crystal dial calibration checker. Antenna loading inductance. Complete conversion data to VFO or FM oscillator is covered in CQ magazine; May '46 issue. Why not use this for your VFO? It's a real buy, 1000 to sell; at this ridiculous price; with tubes. BC-457-A Transmitter 4 to 5.5 MC. Complete with 4600 KC crystal and tubes.....Your Cost **\$3.95**
BC-458-A Transmitter 5.3 to 7 MC. Complete with 6200 KC crystal and tubes.....Your Cost **\$5.95**



Jan or regular brand. Cartoned or uncartoned. Every tube guaranteed.

SCOOP PRICE 49c

12A6	39	12SN7	64	1R5
12H6	76	6SD7	80	
12SH7	37	12SL7	635	12AT6
1631	5Y3	6F8	9003	12BA6
1632	5Y4	26	1R5	12BE6
9001	1633	27	1T4	35W4
6V6GT	1644	6H6	384	50B5
		6SH7	1L4	
		56	3A4	

SCOOP PRICE 59c

6C5	6K7	12SK7	0Y4
6F6GT	41	35L6	12SJ7
6SA7	42	50L6	12SR7
6SK7	6K8	35Z5	6C6
6SQ7	6A8GT	6K6	6D6
12SA7	12J5		77
12SQ7			78

SCOOP PRICE 79c

6SC7	7Q7	7B7	14B6
6SL7	7A8	7C5	35Y4
7A7	7B8	7C6	50A5
7A4	7Y4	7E5	35A5
7B4	7Z4	7F7	117Z6
7A6	14A7	7N7	
7B6	14Q7		

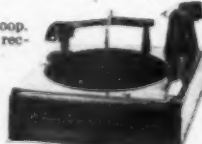
1LD5, 1LN5, 1LH4, 1LA4, 1LB4.....Net 99c
1LC6 and 1LA6.....Net \$1.29 each

BC-1206-C AIRCRAFT SUPERHET RECEIVER

5 tube; 3 gang condenser covers 200 to 420 KC. Designed to operate on 28 volt filament and plate. Complete with tubes 14J7, 2-14H7, 14 I7, a and 25 D7. Has vernier dial and volume control on front panel. Very compact: 4"x4"x7"; weight 6 lbs. Ideal for aircraft or conversion. BC-1206-G with tubes. Scoop price.....\$7.95

AERO AUTOMATIC CHANGER SCOOP PRICE \$13.95

This is a real changer scoop. Plays 12 10-in. or 10 12-in. records. Has all plastic arm with latest crystal cartridge. Brand new and factory cartoned. We have plenty at the scoop price of only \$13.95. Attractive walnut made to fit base \$2.49 extra.



SCOOP. POWER TRANSFORMERS, CHOKES AND INPUTS. \$6.95

Not war surplus. All regular radio type. Nationally known makes. Utah Stancor, etc. Here is the deal. 5 assorted brand new 110 volt AC 60 cycle power transformers. Some are upright and some are mounting. Assorted voltages. 0.3 and 5 volt fil. and high voltage. Some are for the 2 1/2 volt filament type and others have 1 1/2 volt filaments. However all have standard high voltage windings such as used in every day radio receivers. Also 5 assorted standard size receiver chokes and input audio transformers. Our stock is so arranged that we can not give choice as to types. We can guarantee to give you a good value. Scoop 10 assorted power trans, choke, and inputs.....Net \$6.95

BC-654 TRANSMITTER RECEIVER \$12.95 GUARANTEED TO BE IN GOOD CONDITION

7-Tube Superhet Receiver and 6-Tube Trans. with 25 Watts Power.



Order Now at this Scoop Price. Covers 3800 Kc. to 5800 Kc.

Portable voice and CW transmitter and receiver for portable, mobile, and fixed station operation. 7-tube superheterodyne receiver with 3.5 microvolt sensitivity on voice and 0.5 microvolt sensitivity on CW, and 100 milliwatts undistorted power output. 455 KC IF. Uses 3-1N5GT, 1-1A7GT, 2-3Q5GT, 1-1H5GT tubes. 6-tube transmitter, with antenna tuning network, Colpitts thermal compensated oscillator, class C final with 2-307A tubes in parallel, and crystal oscillator for checking frequency every 200 KC. 25 watts output on CW and 11.2 watts output on voice. Frequency range, transmitter and receiver, 3800 to 5800 KC. Ideal for Hamslut! Comes complete with cover; set of tubes installed, 5 spare tubes and 3 spare pilot lights. Less power supplies. These units are used but in good condition. Shipping weight 50 lbs. Net price with all tubes and spares **\$12.95**; 3 for.....**\$25.00** Send your order to our Kansas City store. This unit will be shipped from our Chicago warehouse. Immediate delivery. You can hardly tell they are used. BC-654 Less all tubes and crystal.....\$7.95



BC-645, \$14.95 Each Two for \$29.00

Made by General Electric. Factory printed Conversion Diagram. New, factory cartoned. 15 tubes. Covers 450 mc.

ARMY BC-645 I.F.F. UNIT. Early in the war when radar picked up a plane, there was no way of knowing whether it was friendly or not. What was before BC-645 was invented. BC-645 sent out a signal that identified the plane as American. It probably saved more lives than any other piece of electronic equipment made. With some modifications the set can be used for 2-way communication, voice or code, on the following bands: ham band 420-450 mc., citizens radio 460-470 mc., fixed and mobile 450-460 mc., television experimental 470-500 mc. Equipment capable of doing the jobs of the modified set sells for hundreds and hundreds of dollars. The 15 tubes alone are worth more than the sale price. 4-7F7, 4-7H7, 2-7E8, 2-6F6, 2-955 and 1-WES16A. It now covers 460 to 490 mc. Each BC-645 is shipped with a Belmont factory printed conversion diagram, showing how to make AC power supply modulator and how to make Transmitter and Receiver changes. Most Hams and experimenters already have the few parts necessary. New BC-645 with tubes less power supply. Shipping weight 25 lbs. Extra WES16A Tubes \$1.50 each. 12 Volt Dynamotor.....\$4.95

SCR 522 TRANS. REC. \$19.95

Popular SCR 522 Transmitter Receiver. Covers 100 to 150 M.C. All are in good condition and complete with tubes. The hams are going for these in a big way. Guaranteed to be in good condition.....Net **\$19.95**

PACKARD BELL AMPLIFIER \$1.99

Packard-Bell Model K-1 Pre Amplifier. Small handy aluminum case, size 4x5x4 with tubes, 6SL7 and 28D7. Has input and output transformers, push pull to push pull. Variable gain control and patch cords, patch cord hand switch. Scoop price.....\$1.99

BC-929 INDICATOR SCOPE \$14.95

BC-929 A small aircraft indicator scope. Has 3 inch cathode ray tube and 2 6SN7, 6G6, 2 6H6, 6X5 and 2X3 tubes. This is a beautiful unit to rebuild into a test scope. The chassis and cabinet are an ideal size 8x10x15. It looks almost like a complete test scope, however remember you will have to change the power trans. to a 60 cycle one. Guaranteed to be in good condition and with all tubes. Weight 20 lbs. Scoop Price **\$14.95**

NAVY ARB RECEIVER \$19.95

Scoop Navy Aircraft receiver model ARB, r 4 Bands 195 to 500 KC, 560 to 1600 KC, 1.6 to 4.5 MC.—4.5 to 9.05 MC.—Weight 26 lbs. Has 6 tubes, 4 gang tuning condenser—better than 2-micro volt sensitivity on all bands. Priced complete with 28V Dynamotor and tubes 4-12SF7, 12SA7 and 12A6. Has electric or manual band change switch. This is an ideal aircraft receiver as is or can be converted to AC. Please note the 4 bands this set covers, they are the most popular radio receiver bands. Guaranteed to be in good condition, with all tubes and dynamotor. Navy ARB. Scoop price **\$19.95**

MASTER RADAR RANGE SCOPE \$39.95

RTS-APN-15A. Aircraft Master Radar Range Scope. This unit has no many parts, tubes and controls it is impossible to describe it in full. Weight 50 lbs.—size square case 14x22x26. Guaranteed to be in good condition, priced complete with 43 tubes (6L6's, 6AC7's, 884 etc.) also 2 scope tubes 5FP7 and a small 2" tube. Has 28VDC Blower motor and fan, 3-2" millimeters and more controls than you can shake a stick at. There are so many pieces you probably would spend two days disassembling it. Scoop price **\$39.95**

2-TUBE PHONO-OSCILLATOR

Complete, wired and tested. 800 to 1500 KC. Model B-4. Has audio gain stage for proper power output. Complete with tubes ready to operate.....\$3.69



MIKE-OSCILLATOR

800 to 1500 KC. Mike Oscillator model C-4. Not only does the unit work as a phono-osc., but has added gain stage for a crystal mike. Priced complete, wired and tested with 3 tubes and fader control. Net **\$4.95**. Crystal Mike.....\$4.90 extra



DELUXE MIKE OSCILLATOR

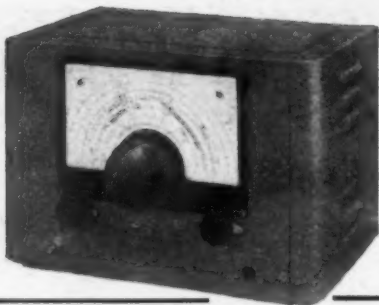
800 to 1500 KC Phono-Mike Oscillator. Makes any receiver a PA system. Record player or Recording amplifier. 3 stage high output unit with power transformer for AC operation only. High gain input stage for crystal or dynamic mike. Control on panel for fading recording to voice, simulating an actual broadcast station. Model DL-5 Complete with 3 tubes, wired and tested. Net **\$7.95**. Crystal Mike.....\$4.90 extra

McGEE RADIO COMPANY

WRITE FOR CATALOG

SEND 20% DEPOSIT—BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

**HAMS! HERE'S THE
BEST CONVERTER BUY
ON THE MARKET...**



Kit or Completely Assembled

Lafayette CONVERTER

For 6, 10 and 11 meters

Frank Lester, famed W2AMJ, back in charge of ham radio at Lafayette comes through with a great ham innovation that you'll want right now!

Designed to operate directly from 105-125 volt 60-cycle A-C source, this converter uses the new selenium rectifier and three new-type miniature tubes. One 6BA6 as tuned R-F stage—one 6BE6 as mixer—one 6C4 as H-F oscillator. Single-dial tuning for controlling H-F oscillator—separate control for R-F stage. This feature eliminates tracking error. Mixer gain may be varied by separate bias control, thus permitting optimum signal-to-noise ratio regardless of receiver used. Stand-by switch controls both converter and receiver. Plug-in coils employed for all bands, one set to cover 50 to 54 mc range and another to cover from 27.180 to 29.7 mc. Output transformer adjustable from 4.7 to 6.5 mc. Kit comes complete with punched chassis, panel and cabinet as well as all parts for one band and complete instructions, less tubes. Gray crinkle cabinet 8" x 12" x 8". Shpg. wt. 15 lbs.

- K10454—Converter kit, less tubes—Your Cost only\$34.50
- K21000—Tubes for converter—Your Cost only 3.00
- K10456—Converter completely assembled, wired and tested with coils for 6, 10, 11 meter operation, including all required tubes—Your cost only 49.50

**WIRED CONVERTER SOLD ON
10 DAY MONEY BACK GUARANTEE!**

Write today for our big, new 144-page catalog—it's chock full of everything you want in radio and electronics. Ask, too, for flyer C-39 with its up-to-the-minute news on ham bargains.

Lafayette Radio

(RADIO WIRE TELEVISION, INC.)

100 Sixth Avenue 110 Federal St. 24 Central Ave.,
New York 13, N. Y. Boston 10 Newark 2, N. J.

Parts Lists

(FOR CIRCUIT DIAGRAMS APPEARING ON PAGES 70 AND 71)

Part No.	Code and Description.
C19753	R ₁ —Vol. control
C20060-150	R ₂ —15 ohm, 1/4 w. res.
C19947 or C19752	R ₃ —Tone control & sw.
C20070-123	R ₄ —12,000 ohm, 1 w. res.
C20060-151	R ₅ —150 ohm, 1/4 w. res.
C20060-474	R ₆ —470,000 ohm, 1/4 w. res.
C20060-225	R ₇ —2.2 megohm, 1/4 w. res.
C20060-156	R ₈ —15 megohm, 1/4 w. res.
C20060-223	R ₉ —22,000 ohm, 1/4 w. res.
C20060-334	R ₁₀ —330,000 ohm, 1/4 w. res.
C20060-681	R ₁₁ —680 ohm, 1/4 w. res.
C20060-103	R ₁₂ —1 megohm, 1/4 w. res.
C19584	C ₁ , C ₂ —Two-gang var. cond.
A19780	C _{3A} , C _{3B} , C _{3C} —10/20/40 µfd., 150/150/150 v. elec. cond.
C20068	C ₄ —0.02 µfd., 400 v. cond.
C20063-501	C ₅ —0.0005 µfd., 500 v. cond.
A19763	C ₆ —2 µfd., 400 v. cond.
C20069	C ₇ —0.02 µfd., 600 v. cond.
C20067-503	C ₈ —0.03 µfd., 200 v. cond.
C20063-500	C ₉ —0.00005 µfd., 500 v. cond.
C20068	C ₁₀ —0.05 µfd., 400 v. cond.
C19754	S ₁ —On-off sw. on R ₃
A19531	S ₂ —Phono-radio sw.
AC19587-1	S ₃ —Phono motor socket
AC19588-1	T ₁ —First i.f. coil assembly
AC19591-1	T ₂ —Second i.f. coil assembly
AC19586-1	T ₃ —Output trans.
AC19589-1	L ₁ —Osc. coil assembly
	L ₂ —Choke assembly

Part No.	Code and Description.
B-135878	5—Output trans.
B-135459	6—1000 µfd., 10 v. elec. cond.
B-135553	7A, 7B—40/40 µfd., 100/150 v. elec. cond.
AB-136366	8A, 8B—Two section var. cond.
39001-17	9, 12, 13—0.5 µfd., 600 v. cond.
39001-19	10, 11—1 µfd., 600 v. cond.
39001-76	14, 15—0.03 µfd., 600 v. cond.
39001-73	16—250 µfd., 600 v. cond.
39294-25	17—100,000 ohm, 1/2 w. res.
39294-34	18, 19—3.3 megohm, 1/2 w. res.
39294-37	20—10 megohm, 1/2 w. res.
39294-30	21—680,000 ohm, 1/2 w. res.
W-132502	22—1900 ohm, 5 w. res.
39014-24	23—820 ohm, 1/2 w. res.
39294-11	24—470 ohm, 1/2 w. res.
39014-40	25—18,000 ohm, 1/2 w. res.
39294-21	26—22,000 ohm, 1/2 w. res.
39294-19	27—10,000 ohm, 1/2 w. res.
C-132300-3	28—Cable and power plug
39001-87	29—25 µfd., 600 v. cond.
39001-13	30, 31, 32—0.1 µfd., 600 v. cond.
39001-7	33—0.01 µfd., 600 v. cond.
39294-31	34—1 megohm, 1/2 w. res.
AW-133774	35—First i.f. trans.
AW-133769	36—Second i.f. trans.
AW-134620	37—Osc. coil
B-226638-54	42—75 µfd., 500 v. ceramic cond.
Part of 36	44—47,000 ohm, 1/2 w. res.
B-135353	45A, 45B—1 megohm vol. control & sw.

Part No.	Code and Description.
C-9B1-26	R ₁ —20,000 ohm, 1/4 w. res.
C-9B1-50	R ₂ , R ₃ , R ₄ —470,000 ohm, 1/4 w. res.
C-9B1-70	R ₅ —33 ohm, 1/4 w. res.
C-9B1-25	R ₆ , R ₇ —3.3 megohm, 1/4 w. res.
C-9B1-82	R ₈ —500,000 ohm, 1/4 w. res.
C-9B1-42	R ₉ , R ₁₀ —170 ohm, 1/2 w. res.
C-9B2-54	R ₁₁ —22 ohm, 1/2 w. res.
C-9B2-63	R ₁₂ —18,000 ohm, 1 w. res.
C-9B1-52	R ₁₃ —670 ohm, 1/2 w. res.
C-9B1-34	R ₁₄ —1000 ohm, 1/2 w. res.
C-9B1-29	C ₁ —Omitted
C-9B1-27	C ₂ , C ₃ —30 µfd. cond.
101193	C ₄ , C ₅ , C ₆ —0.5 µfd., cond.
C-9B1-23	C ₇ —350 µfd. cond.
C-9B1-35	C ₈ —25 µfd. cond.
C-9B2-44	C ₉ , C ₁₀ —250 µfd. cond.
B-8A-10211	C ₁₁ —0.04 µfd. cond.
C-8D-10761	C ₁₂ , C ₁₃ —0.2 µfd. cond.
C-8F3-114	C ₁₄ , C ₁₅ —20 µfd. cond.
C-8D-10774	C ₁₆ —30 µfd. cond.
C-8D-10760	L ₁ —Tuning coil
C-8D-10775	L ₂ —Osc. coil
C-8F3-8	L ₃ —Padder coil

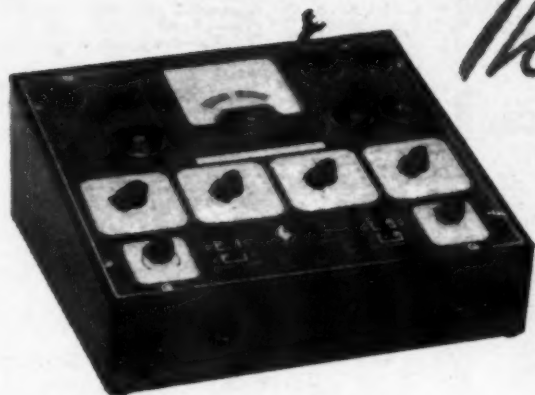
Part No.	Code and Description.
BR12G-513	R ₁ —51,000 ohm, 1/2 w. res.
BR12G-223	R ₂ —22,000 ohm, 1/2 w. res.
CR12G-473	R ₃ —47,000 ohm, 1 w. res.
DR12G-223	R ₄ —22,000 ohm, 2 w. res.
BR12S-335	R ₅ —3.3 megohm, 1/2 w. res.
PA4402-1	R ₆ —5 megohm vol. control
BR12S-101	R ₇ —100 ohm, 1/2 w. res.

BR12S-106	R ₈ —10 megohm, 1/2 w. res.
BR12S-274	R ₉ —270,000 ohm, 1/2 w. res.
PA4400-5	R ₁₀ —5 megohm tone control
CR12G-221	R ₁₁ —220 ohm, 1 w. res.
BR12G-474	R ₁₂ , R ₁₃ , R ₁₄ —470,000 ohm, 1/2 w. res.
BR12S-150	R ₁₅ —15 ohm, 1/2 w. res.
CR12G-202	R ₁₆ —2000 ohm, 1/2 w. res.
PA4200-5	R ₁₇ —2700 ohm, 5 w. wirewound res.
PB40403	C _{1A} , C _{1B} —Var. cond.
PA4333-2	C ₂ —Broadcast osc. padder
PA4333-2	C ₃ —Broadcast osc. trimmer
PA4333-2	C ₄ —Broadcast ant. trimmer
PA4333-2	C ₅ —S.w. osc. trimmer
PA4333-2	C ₆ —S.w. ant. trimmer
AB43500-45	C _{7A} , C _{7B} —First i.f. trimmer
AB43500-55	C _{8A} , C _{8B} —Second i.f. trimmer
PC40FM-503	C ₉ —0.05 µfd., 600 v. cond.
MC60E-510	C ₁₀ —51 µfd. mica cond.
MC60G-241	C ₁₁ , C ₁₂ —240 µfd. mica cond.
PC40GL-104	C ₁₃ —1 µfd., 400 v. cond.
PC40GL-503	C ₁₄ , C ₁₅ —0.5 µfd., 400 v. cond.
MC60G-101	C ₁₆ , C ₁₇ —100 µfd. mica cond.
PC40GN-102	C ₁₈ —Omitted
PA4300-5	C ₁₉ —0.01 µfd., 1000 v. cond.
PC40GM-104	C ₂₀ —15/10 µfd., elec. cond.
PC40GM-203	C ₂₁ —1 µfd., 600 v. cond.
PA4334-3	C ₂₂ —0.2 µfd., 600 v. cond.
PC40GK-103	C ₂₃ —2575 µfd. padder
AB43014-1	C ₂₄ —Omitted
AA6751-1	C ₂₅ —0.1 µfd., 200 v. cond.
AA6752-1	L ₁ —Broadcast ant. loop
AA6753-1	L ₂ —Omitted
AA6800-3	L ₃ —S.w. ant. coil
AA6800-2	L ₄ —Broadcast osc. coil
	L ₅ —S.w. osc. coil
	L ₆ —First i.f. coil
	L ₇ —Second i.f. coil

Part No.	Code and Description.
R ₁ —22 ohm, 1/2 w. res.	
R ₂ —22,000 ohm, 2 w. res.	
R ₃ —2200 ohm, 1/2 w. res.	
R ₄ —Vol. control & sw.	
R ₅ —10 megohm, 1/4 w. res.	
R ₆ —270,000 ohm, 1/2 w. res.	
R ₇ —470,000 ohm, 1/4 w. res.	
R ₈ —150 ohm, 1 w. res.	
R ₉ —2.2 megohm, 1/4 w. res.	
R ₁₀ —0.05 µfd., 400 v. cond.	
C ₁ , C ₂ , C ₃ —0.5 µfd., 400 v. cond.	
C ₄ —47 µfd. mica cond.	
C ₅ , C ₆ , C ₇ —40/40/25 µfd., 150/150/25 v. elec. cond.	
C ₈ —220 µfd., 500 v. mica cond.	
C ₉ —0.02 µfd., 400 v. mica cond.	
C ₁₀ —470 µfd., 500 v. mica cond.	
C ₁₁ —0.1 µfd., 400 v. cond.	
L ₁ —Loop antenna	
L ₂ —Osc. coil	
L ₃ —First i.f. trans.	
L ₄ —Second i.f. trans.	

Part No.	Code and Description.
C-9B1-26	R ₁ , R ₂ —150,000 ohm, 1/2 w. res.
C-9B1-50	R ₃ —100 ohm, 1/2 w. res.
C-9B1-70	R ₄ —4700 ohm, 1/2 w. res.
C-9B1-25	R ₅ —100,000 ohm, 1/2 w. res.
C-9B1-82	R ₆ —47,000 ohm, 1/2 w. res.
C-9B1-42	R ₇ —22 ohm, 1/2 w. res.
C-9B2-54	R ₈ —220 ohm, 1 w. res.
C-9B2-63	R ₉ —1200 ohm, 1 w. res.
C-9B1-52	R ₁₀ , R ₁₁ —150 ohm, 1/2 w. res.
C-9B1-34	R ₁₂ —3.3 megohm, 1/2 w. res.
C-9B1-29	R ₁₃ —470,000 ohm, 1/2 w. res.
C-9B1-27	R ₁₄ —220,000 ohm, 1/2 w. res.
101193	R ₁₅ , S ₁ —1 megohm vol. control & sw.
C-9B1-23	R ₁₆ —47,000 ohm, 1/2 w. res.
C-9B1-35	R ₁₇ —4.7 megohm, 1/2 w. res.
C-9B2-44	R ₁₈ —33 ohm, 1 w. res.
B-8A-10211	C ₁ , C ₂ , C ₃ —Two gang cond. with osc. & ant. trimmers
C-8D-10761	C ₄ —0.1 µfd., 400 v. cond.
C-8F3-114	C ₅ —120 µfd., 500 v. mica cond.
C-8D-10774	C ₆ , C ₇ —0.2 µfd., 400 v. cond.
C-8D-10760	C ₈ —1 µfd., 400 v. cond.
C-8D-10775	C ₉ —25 µfd., 200 v. cond.
C-8F3-8	C ₁₀ , C ₁₁ , C ₁₂ —100 µfd., 500 v. cond.
11994	C ₁₃ , C ₁₄ —40/20/20 µfd., 150/150/150 v. elec. cond. (for 60 cycles)
11995	C ₁₅ , C ₁₆ , C ₁₇ —60/40/40 µfd., 150/150/150 v. elec. cond. (for 25 cycles)
C-8D-10770	C ₁₈ —0.5 µfd., 200 v. cond.
C-8D-10788	C ₁₉ —0.04 µfd., 600 v. cond.

RADIO NEWS



The New Model 60-T TUBE and SET TESTER

A COMPLETE TUBE TESTER

Tests all tubes including the new post-war miniature loctals such as the 12AT6, 12AU6, 35W4, 50B5, 117Z3, etc. • Tests by the well-established emission method for tube quality, directly read on the scale of the meter • Tests shorts and leakages up to 3 Megohms in all tubes • Tests leakages and shorts of any one element against all elements in all tubes • Tests both plates in rectifiers • Tests individual sections such as diodes, triodes, pentodes, etc., in multi-purpose tubes.

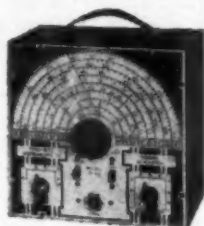
Model 60-T operates on 90-120 Volts 60 Cycles A.C. Housed in sloping leatherette covered cabinet. Comes complete with test leads, tube charts and detailed operating instructions.

EXTRA: WE CAN NOW SUPPLY THE MODEL 60 HOUSED IN A BEAUTIFUL HAND-RUBBED OAK CABINET. COMPLETE WITH PORTABLE COVER MAKING IT SUITABLE FOR EITHER BENCH OR OUTSIDE USE. ONLY \$2.75 ADDITIONAL. SPECIFY MODEL 60-C.

A COMPLETE MULTI-METER

- 6 D.C. Voltage Ranges:
0 to 7.5/15/75/150/750/1,500 Volts
- 6 A.C. Voltage Ranges:
0 to 15/30/150/300/1,500/3,000 Volts
- 4 D.C. Current Ranges:
0 to 1.5/15/150 Ma. 0 to 1.5 Amps.
- Low Resistance Range:
0 to 2,000 Ohms
(1st division is 1/10th of an ohm.)
- 2 Medium Resistance Ranges:
0 to 20,000/200,000 Ohms
- High Resistance Range: 0 to 20 Megohms
- 3 Decibel Ranges:
-10 to +38 +10 to +38 +30 to +58 D.B.

\$49⁸⁵
NET PRICE



THE NEW MODEL B-45

SIGNAL GENERATOR

Complete, ready to operate. . . . **\$27⁷⁵**

Self-modulated — provides a highly stable signal. RF frequencies from 150 Kc. to 12.5 Mc. on Fundamentals and from 11 Mc. to 50 Mc. on Harmonics.

Modulation is accomplished by grid-blocking action — equally effective for alignment of amplitude and frequency modulation as well as for television receivers. Self-contained batteries. All calibrations are etched on the front panel, permitting DIRECT READING.

Model B-45 uses a beautifully processed dualtone front panel. Comes housed in a heavy-gauge crystalline steel cabinet complete with shielded test lead, self-contained batteries and instructions.



THE NEW MODEL 670

SUPER METER \$28⁴⁰

A Combination VOLT-OHM-MILLIAMMETER plus CAPACITY REACTANCE, INDUCTANCE and DECIBEL MEASUREMENTS

D.C. VOLTS: 0 to 7.5/15/75/150/750/1500/7500.
A.C. VOLTS: 0 to 15/30/150/300/1500/3000 Volts.
OUTPUT VOLTS: 0 to 15/30/150/300/1500/3000.
D.C. CURRENT: 0 to 1.5/15/150 Ma.; 0 to 1.5 Amps.

RESISTANCE: 0 to 500/100,000 ohms 0 to 10 Megohms.
CAPACITY: .001 to .2 Mfd., .1 to 4 Mfd. (Quality test for electrolytics).
REACTANCE: 700 to 27,000 Ohms; 15,000 Ohms to 3 Megohms.
INDUCTANCE: 1.75 to 70 Henries; 35 to 8,000 Henries.
DECIBELS: -10 to +18, +10 to +38, +30 to +58.
The Model 670 comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 5 1/2" x 7 1/2" x 3".



THE NEW MODEL CA-11

SIGNAL TRACER \$18⁷⁵

Simple to operate . . . because signal intensity readings are indicated *directly on the meter!*

- ★ SIMPLE TO OPERATE — only 1 connecting cable — NO TUNING CONTROLS.
- ★ HIGHLY SENSITIVE — uses an improved Vacuum Tube Voltmeter circuit.
- ★ Tube and resistor-capacity network are built into the Detector Probe.

- ★ COMPLETELY PORTABLE — weighs 5 lbs. and measures 5" x 6" x 7".
- ★ Comparative Signal Intensity readings are indicated directly on the meter as the Detector Probe is moved to follow the Signal from Antenna to Speaker.
- ★ Provision is made for insertion of phones.

The Model CA-11 comes housed in a beautiful hand-rubbed wooden cabinet. Complete with Probe, test leads and instructions.



THE NEW MODEL 450

TUBE TESTER \$39⁵⁰

Speedy operation — assured by newly designed rotary selector switch which replaces the usual snap, toggle, or lever action switches.

SPECIFICATIONS

- Tests all tubes up to 117 volts.
- Tests shorts and leakages up to 3 Megohms in all tubes.
- Tests individual sections such as diodes, triodes, pentodes, etc., in multi-purpose tubes.
- Noise Test — detects microphonic tubes or noise due to faulty elements and loose internal connections.
- Uses a 4 1/2" square rugged meter.
- Works on 90 to 125 volts 60 cycles A.C.

EXTRA SERVICE — May be used as an extremely sensitive condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute.

OUR POLICY

We do not advertise any unit which is not available for immediate shipment from stock. • Less flowery adjectives, more detailed specifications. • All units are sold subject to one year guarantee except when components are damaged through misuse. • We do

not solicit orders for any unit that does not meet our requirements for accuracy and honest value. Any item purchased from us is sold with the understanding that it may be returned for full refund after a 10 day trial.

20% DEPOSIT REQUIRED ON ALL C.O.D. ORDERS

GENERAL ELECTRONIC DISTRIBUTING CO.

DEPT. RN-7, 98 PARK PLACE, NEW YORK 7, N. Y.

July, 1947

87

Presenting

*Another
E. M. C. First !!*

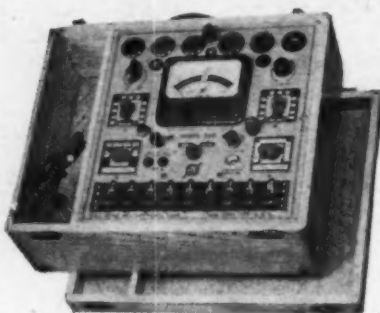
YES! For the first time in radio history, here is a completely flexible Mutual Conductance type tube tester—at an emission-type price!

HAS CALIBRATED MICRO-MHO SCALE

Checks Tubes for Gas Content

See this distinguished addition to the E.M.C. line of quality test instruments at your regular jobber. See for yourself the ease and accuracy in testing all types of tubes that the Model 200 provides. Select a counter or portable model for YOUR shop, and let this instrument go to work for you—increasing your tube profits!

The E.M.C. Model 200 MUTUAL CONDUCTANCE TUBE TESTER



Model 200 BC—4½" meter in sloping counter case..... **\$5285**

Model 200 BP — (ILLUSTRATED) 4½" meter in hand rubbed carrying case..... **\$5685**

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Electronic Measurements Corp.
114 Liberty St. • New York 6, N. Y.



HOME SOLDERING IRON with PROFESSIONAL DESIGN

New G.E., makers of industrial soldering irons for over 25 years, offers home craftsmen a moderately priced iron with a professional design. Has same type heater used in industrial models. Quick heating. Built for long service. A brazed tip gives the heat a smooth path to travel.

The G-E Handy iron can do a variety of soldering jobs—from repairing a loose wire to model building. Most dealers now have Handy irons. Ask to see one today. Or write to Dept. 667C-2, Apparatus Department, General Electric Company, Schenectady 5, N. Y.

Free: "How to Solder" manual with every iron

GENERAL ELECTRIC

WANTED!

Articles by Radio Amateurs

2000 to 2500 words

Covering any material of genuine interest to radio amateurs, such as:

- Transmitters
- Receivers
- Antennas
- Test Equipment

Articles should be typewritten (double spaced) and accompanied by suitable diagrams, photos, and parts lists. Liberal payment will be made upon acceptance.

Address all communications to
Box 419

RADIO NEWS

185 North Wabash Avenue
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C-8D-10942
B-212-11062
or
B-212-11404
A-13D-10215
108140G
108145C
10595B
C₁—47 μfd., 500 v. mica cond.
C₂—0.002 μfd., 600 v. cond.
C₃—2 μfd., 400 v. cond.
T₁, T₂—Loop antenna assembly with C₁, C₂, T₃
T₃—Osc. coil
T₄—Input i.f. coil with 56-104 μfd. trimmers
T₅—Output i.f. coil with 56-104 μfd. trimmers
T₆—Output trans.

R.F. Power Supply

(Continued from page 54)

The circuit shown is for operation of a cathode-ray tube hence the bleeder connection to potentiometers for the focus and intensity controls. This power unit has another important industrial application that has not been mentioned, namely, a means for testing high voltage condensers. The high voltage condenser can be tested by connecting it in series with a suitable resistor (so as not to load the circuit) across the high voltage. This method is safe and the operator cannot be hurt due to carelessness.

The diagram also shows recommended coil design for such a power supply. It shows the number of turns and their orientation on the form, as well as the method of winding and the type of wire used.

The maintenance of these units is rather straightforward if the serviceman realizes that the Q of the coils must be preserved to obtain the proper operating voltages in the circuits in which this unit is to be used.

The measurement of the voltage output is a trifle difficult as most voltmeters load the circuit so much that the voltage is substantially less than when the unit is in operation. The voltmeter required must have a very high impedance but if one is not available the power supply can be used as power on a cathode-ray tube and the resultant deflection sensitivity measured by applying a known voltage to the deflecting plates.

FM SERVICE SCHOOL ON COAST

A UNIQUE radio servicing school has opened its doors in San Francisco for the training of journeyman radio technicians in the techniques of servicing FM receivers.

Sponsored jointly by the Radio Division No. 1245 of AF of L's International Brotherhood of Electrical Workers, the San Francisco Board of Education and manufacturers of FM receivers, the course has 70 enrollees in its first class.

Instruction is being given by Kenneth Nielsen, chief engineer of the Board of Education's non-commercial FM outlet, Station KALW. Students are taught the method of receiving FM signals, and the new techniques in receiver servicing as applied to currently available receivers. The General Electric Company has already supplied FM instruction booklets and service notes. Other companies are expected to follow suit.

Walkie Talkies!

THE FAMOUS ARMY RADIO

Here is a complete, portable phone station which comes to you ready to operate with a flip of the switch. There's nothing else to buy. It contains its own power supply, antenna and receiver — microphone handset.

Walkie Talkies are not only popular sets for Amateur field trips but may also be used for dependable radio communication for police, fire department or Government work, etc.

BC 222 Walkie Talkie Features

- Covers 28 to 52 Mc range with two plug-in coils.
- Covers 10 and 6 meter Amateur phone bands. Can be modified easily to cover 2 meter band.
- Crystal Calibrator for accurate frequency check.
- Range up to 15 miles. Battery supplies 80 hours of continuous service.
- Telescopic antenna requires little space when not in use.
- Relay operated send-receive switch.
- Ruggedly constructed for rough handling.

Model BC 222 — Complete with battery. Renewed and tested by the Government — only \$45.00 each.

Model BC 322 — Same as BC 222 but covers 52 to 65 Mc range. Has carrying case and battery adaptor. New only \$75.00 each.

Special Microphone Cable

Highly flexible, single conductor, No. 18 silver plated tinsel wire, copper braid shielded, rubber covered. Outside diameter .235. Price only \$50.00 per thousand feet. Minimum quantity 500 feet

When in Chicago Visit Our Tremendous New Display of Thousands of Radio-Electric Items

Your Distributor Can Supply You With Any Wells Material At Advertised Prices

WELLS SALES, INC.

DEPT. R-7, 320 N. LA SALLE ST., CHICAGO 10, ILL.

Extra Batteries for BC 222 and BC 322 Walkie Talkies

These batteries are especially built in metal cases. Just plug in and you're ready for another 80 hours of continuous service. (Batteries last much longer in normal use.) Price \$4.75 each.
Battery Adaptor. Permits Walkie Talkie operation with standard commercial A and B batteries. Price \$2.50 each.

Wells Sales, Inc., Dept. R-7, 320 N. LaSalle St., Chicago 10, Ill.

Please ship _____ BC 222 Walkie Talkies @ \$45.00 each

_____ BC 322 Walkie Talkies @ \$75.00 each.

_____ Extra Batteries @ \$4.75 each.

_____ Battery Adaptors @ \$2.50 each.

For which my check (or M.O.) for \$_____ is enclosed.

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

NEW! SENSATIONAL!
Outsells Everything
IN RADIO WHEREVER INTRODUCED!



**AN ANSWER TO THE
PRESIDENT'S PLEA**

\$12⁹⁵ RETAIL

WOOD CONSTRUCTED CABINET

A NEW NOTE IN LOW PRICES—SELLS ON SIGHT!

It's here! The Lee 400. Designed and packaged for fast over-the-counter selling. Only 5" High.

Its wood cabinet construction and its colorful suede-like finish makes it the biggest little package of radio power to hit the market at such a low price.

NOT DISTRESSED MERCHANDISE!

Tops in engineering! And it can't be beat for price, quality and attractiveness.

the
Lee
400

A VARIETY OF COLORS!

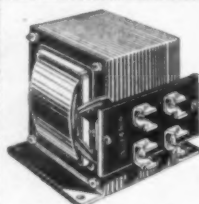
Gold • Red • Emerald • Pastel Pink
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**THORDARSON
6.3 Volt Filament
TRANSFORMERS**

**115 V., 50/60 Cy.
Primary, 6.3 Volts at
10 Amps. Sec.**

Leads brought out on an engraved bakelite panel—Wt. 5 lbs. Size 3 x 3 x 3 inches. With mounting brackets. Suitable for filament supply, battery charges, "A" supplies, pinball machines, bell-ringers, toys, etc.

3 to a carton—no less than 3 sold.
PRICE.....\$1.95
 Lots of 12, each.....**\$1.75**

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 Licensed by New York State

**Don't forget
to refer to the**

RADIONIC

Catalog!

Deluxe Super

(Continued from page 49)

ax tank circuit to the particular antenna used, which goes without saying, must be a proper one for this band.

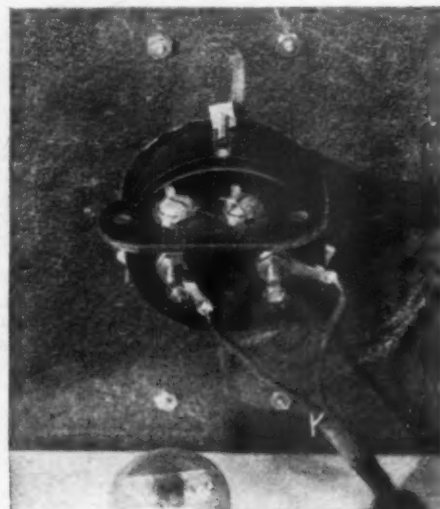
This should about complete the job and at this point it will be necessary to transform yourself into a roving missionary and persuade some of the other local hams to become sufficiently interested to desert the 10 meter DX and work with you. You will find the land line telephone a practical necessity on anything like these frequencies for the preliminary get together, but once signals have traversed the distance of your town, it will only be necessary to use the thing whenever you want to work each other, more or less. After all, you are now the proud owner of a 425 mc. superhet receiver, which is not obtainable anywhere commercially at any price and was practically unheard of in 1941 in the ham circles. All this for less than 25 bucks, too. Lots of luck and if you live near Dallas, Texas, we can use a few more QSO's on 425 before the QRM situation becomes intolerable. Give us a shout.

-30-

**INCREASING METER
RANGE**

IN order to increase the current capacity of a 0-100 ma. meter used in the final plate circuit of a transmitter, mount a two-screw terminal strip directly onto the binding posts of the meter and add a shunt consisting merely of a small piece of resistance wire removed from an old bleeder resistor. Getting exactly the correct amount of resistance is only a matter of a few minutes. Adjust the load on the tube so that the meter reads exactly 100 ma. Then try different lengths of resistance wire until the scale reads exactly 50 ma., and tighten the terminal screws firmly.

During periods of off-resonance operation the needle now merely swings safely up around the 75 ma. mark (meaning that 150 ma. is flowing), instead of wrapping itself around the stop pin, as it did before. . . . D. J. B.



RADIO NEWS

SPRAGUE TRADING POST

.. A Mighty Good Thing to Have Around Your Shop or Store

See your Sprague jobber! Buy 6 Sprague IF-37 Interference Filters mounted and displayed on this attractive card. Use it on your counter, on the wall or in the window. Let customers know that you can now give prompt, effective service in reducing radio interference from fluorescent lights—even the kind that is conducted down power lines to re-

motely located fixtures. Sell IF-37's to customers who want to make their own interference suppression installations. And be sure to install filters on fluorescent lights in your own store to assure better, quieter radio and television demonstrations. Use one IF-37 Filter with each fluorescent auxiliary—and watch radio noises disappear!

SWAP • BUY • SELL

WANTED—S-20-R or similar receiver; also hi-voltage transformer. Bob Gullinger, W5LRZ, 111 Highland Ave., Seminole, Oklahoma.

FOR SALE—3-band receiver R-100/URR, 54/1.5 mc., 3.6/8.5 mc., 8.5/19 mc. a-c, d-c or battery, excellent condition, \$75; 14" 110 V. a-c speaker, \$7.50; 8 to 15 watt 2A3 phono amp., 12" dyn. spkr., dual tone controls, very good, \$37.50; new Dumont batt. radios, \$34.95. Mc's Radio, 207 N. Cedar, Abilene, Kan.

WANTED—BC-624 receiver from SCR-522A. For sale 8X-25, \$80; LF-90, \$20. Both used less than 100 hours. Paul West, Box 722, Martinsburg, W. Va.

FOR SALE—NC-2-40D receiver, complete with matching speaker, brand new, used less than 50 hours. Paid \$241.44. QST's 1940 to date. Jno. D. Durham, S. Collins St., Richmond, Ky.

FOR SALE—National NC-46 receiver and spkr., excellent condition, \$90. M. W. Donnell, Box at Grand and Hemlock, Enid, Okla.

FOR SALE—6 V. d-c to 350 V. d-c 500 ma. rotary converter, like new, \$30; many parts and tubes such as 1A7, 50L6, 35Z5; etc. Write for particulars. Don Becker, Wolf Point, Mont.

FOR SALE—Collins ART-13 x'mitter converted for 110 V. a-c, \$280; 8X-25 perfect condition, less spkr., \$90; Hickok 110B VTVM up to 10,000 d-c, new, \$50; Waterman pocketscope, little used, \$45. Write for complete information. W. Z. Ferguson, P.O. Box 102, Kosciusko, Wis.

WANTED—Used Hallicrafters or National communications receiver; also code practice machine. Must be in working order. Ellis A. Kruse, 1326 Meridian Ave., Miami Beach 39, Fla.

FOR SALE—Peerless transformers: P-5151-T; 1560-1230-0-1230-1560 at 420 ma., \$19.95; Kenyon T-389 2.5 V. c.t. at 10 amps., 9000 V. insulation, \$3.50; Kenyon 7.5 V., 12 amps., \$3.50. WSTH, 545 Aberdeen Ave., Dayton 9, Ohio.

SELL OR SWAP—R-100/URR a-c, d-c, batt. 110-220 V. military morale receiver. 8.5/19 mc., 3.6/8.5 mc., and broadcast band. \$35 cash f.o.b. New 807 tubes, \$1.05; new 68F7/GT uncased, 50c. Need Laboratory equip., C. J. Wazio, 1905 W. Monterey, Chicago 43, Ill.

SELL OR SWAP—60-70% off, tubes all types boxed and guaranteed. Other radio parts equally low, want television set, hit, short wave receiver, photographic equipment, camera, etc. H. Gurchewitz, 147 Chester St., Brooklyn 12, N. Y.

SELL OR SWAP—Speco sig. tracer, amplifier, new condition, \$40 or what have you? International Telegraph variable condenser, 85 plates, max. capacity 5 mfd. Want x'tal for Bendix communications receiver 3103. C. E. Bower, 6005 Interbay Blvd., Tampa 6, Fla.

WANTED—Thordarson transformers: T19F83; 33A91; 75D10; 11M77; 75R50; 19F95; 19F59; 19F90; 19F62; 19C42; 19C36; 19C43. Cash or swap. J. E. Howell, 501 W. Harden St., Graham, N. C.

WANTED—2000 V. plate transformer at 300 ma.; good 10-mtr. converter. Sell dynamotor, 28 V. d-c—1000 V. d-c at 350 ma.; 1½ hp. Briggs & Stratton engine or swap for x'mitter components. What have you? Answer all letters. Tom Neverson, Woods Hole, Mass.

FOR SALE—8" Jensen L-18 spkr., A-1 condition, \$50; new American Beauty 200 watt soldering iron, \$7.50; new Klein longnose pliers, \$2.35 ea. f.o.b. M. A. Porter, 1709 N. Larrabee St., Chicago 14, Ill.

FOR SALE—RCA junior velocity mike. \$12. S. H. Heil, Box 22, Hagerstown, Md.

FOR SALE—HQ-129X with speaker, original carton, purchased few months ago, perfect shape, \$145. Horman Schlemm, Jr., Strasburg, Pa.

FOR SALE—Hammarlund HQ-129X receiver complete with 10" Jensen PM speaker and tubes. Almost new. M. X. Feld, Roosevelt, N. J.

WANTED—One PL-50 plug and cord to fit BC-375E transmitter. Advise price. All letters answered. C. L. Haney, 409 Florence Ave., Dunsmuir, Calif.

FOR SALE—Army super-pro in perfect condition. Rack mounted with power supply less speaker. Recently factory aligned. \$195; BC-348 schematic, \$1; Vibropex "original," never used, \$12; BC-348, a-c converted, \$60. W20XE, 71 Crosshill St., Staten Island, N. Y.

FOR SALE—National FB-7A receiver with built-in stage of RF pre-selection, 20-40-80 mtr. coils, plus 2 new blank National coil forms. In perfect operating condition—a bargain. WIKWQ, Gunter Field, Montgomery, Ala.

TRADE—Complete NRI radio course with VTOM meter for radio parts, tubes, etc. Earl R. Fry, 1311 E. 11th St., Winfield, Kan.

WANTED—Wire recorder, with or without amplifier. Kit or assembled. All replies answered. W. W. London, 122 King St., Charleston 5, S. C.

WANTED—Instructograph code outfit with or without oscillator. C. Gutman, 4415 Esplanade Ave., Montreal, Canada.

FOR SALE—19-tube FM-AM-SW Lafayette Concerto. Hi-impedance amplifier input jacks, 2 chassis, 2 spkrs., all tubes, in perfect condition, \$98 or swap for good communications set. N. Forcier, 293 Jefferson, Salem, Mass.

FOR SALE—Sonar narrow band FM exciter, new condition, \$25. Or trade for folding camera. Ray Froelich, W5YAD, R. No. 1, Whitehall, Mich.

FOR SALE—Electron tube 1A5G/GT and socket. Never been used, \$1.50; variable condenser, 2 gang, model 200; 420-420 multi-band, \$3. All for \$4. Charles Myers, 1627 E. Hawthorne St., Tucson, Ariz.

FOR SALE—Hi-fi audio transformers: output transformers, power transformers; chokes; low impedance input trans. Others, send for list. J. J. Ratkowski, 195 Engert Ave., Brooklyn 22, N. Y.

SELL OR SWAP—PE-73EM 24-28 V. to 1000 V., 350 ma. dynamotor, .00024 mica, 8000 V. condenser, both part of BC-375E transmitter, used but guaranteed. Want 450 ma. hi-V. insulated chokes; .001 mfd. mica 8-10,000 V.; 864 ill. transformers 10,000 V. insul. State offer, condition of item for trade. H. Sibilla, 1441 Goffe St., St. Clair, Mich.

WANTED—SX-28; Hallicrafters BC-610 x'mitter. All letters answered. Will pay shipping costs to my home in Penna. Stephen Antony Dwyer, c/o American Forces Network, APO 179, c/o Postmaster, New York, N. Y.

SELL OR SWAP—Brand new govt. surplus sender-receiver 19-SG-3673, complete plus spare set of tubes. Will swap for Hallicrafters 8-38 or what have you? T. O. Britt, Box 206, Bladenboro, N. C.

WANTED—Tubes for old Atwater-Kent receiver: U-280, CX-380 rectifiers; UX-226; CX-326; UX-171A and CX-171A. Gene Cain, Box 34, Elizabethtown, N. C.

WANTED—To buy: used Echophone receiver, or similar model. Jack Miller, 1017 Cedar, South Bend 17, Ind.

WANTED—PE-103. Have new Radio Handbook; Rider's Servicing Receivers by Resistance Measurements; Ghirardi's Radio Physics Course; G.E. Radio Operators Manual. Marc Molynieux, Jr., Rt. 1, Saranac, Ala.

FOR SALE—BC-342-C, used. Good reception on all bands, no backlash in tuning gears, 115 V./60 cy. Used about 6 months. Ready to operate. \$40 complete. M/Sgt. V. D. Taber, SMAAP, Sqdn. B-3, San Marcos, Tex.

FOR SALE—Western Electric 18A mobile x'mitter; W.E. 18B mobile receivers, with a-c power supply. \$100. Davis Radio Service, 780 Gordon St., Piqua, Ohio.

FOR SALE—Mark II model B-19 combination x'mitter-receiver, never used, \$50. S/Sgt. J. S. Dugger, Lock Box 153, Hantouli, Ill.

SELL OR SWAP—Radio Course including Radionics, x'mitters, television, sound pictures and electronics. National Schools course. Cash or trade. J. B. Quinlan, 1024 S. Goodman St., Rochester 7, N. Y.

FOR SALE—RME receiver, Gal-o-matic two-speed tuning, VR-150 voltage-regulator tube. A-1 condition. \$169. Robert Greenen, 518 Liberty St., Aurora, Ill.

FOR SALE—2 sections 26' long, new Ampholol HG-U8 co-axial feeder cable, 52 ohms, 2c a foot; also 35' new Ampholol 300 ohm antenna cable, 2c a foot. Postpaid. H. Fischer, 626 Carlton Ave., Brooklyn 17, N. Y.

FOR SALE—Overstock of radio tubes, 60% off list price in lots of 50, will make better price on entire lot. Electric Farm Supply, Britt, Iowa.

SWAP—Brand new tubes in cartons; tube tester; battery portable chassis; G.E. service manual and other parts for a communications receiver. G. H. Hague, 6 Carver St., Fall River, Mass.

FOR SALE—Hallicrafters SX-28A complete with PM-15 spkr. Only 1-year old, recently overhauled at Hallicrafters service station for improved 10-mtr., and noise limiter reception and realigned. G. O. Preston, 606 Birch, San Mateo, Calif.

FOR SALE—153 QST's, 1936 through 1946 complete; tube tester, Webber; Knapp A power eliminator; BCL condensers. H. Schroeder, 922 Fair Oaks Ave., Madison 4, Wis.

WANTED—Dynamotor for BC-223A transmitter (SCR-245); also tech. manual for same and tuning unit covering 2-3 meg. band; tech. manual for T1Y transceiver. Kewenaw Radio Shop, 316 6th St., Calumet, Mich.

YOUR OWN AD RUN HERE FREE

The Sprague Trading Post is a free advertising service to our radio friends. Providing only that it fits in with the spirit of this service, we'll gladly run your own ad in the first available issue of one of the six radio magazines in which this feature appears. Write CAREFULLY or print. Hold it to 40 words or less, and confine it to radio subjects. Make sure your

meaning is clear. No commercial advertising or advertising offering merchandise to the highest bidder is acceptable. Obviously, Sprague assumes no responsibility in connection with merchandise bought or sold through these columns or the resulting transactions.

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(Jobbing distributing organization for products of the Sprague Electric Co.)

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*Trademark Reg. U. S. Pat. Off.

26,000 SERVICEMEN READ



EVERY MONTH

*Paid circulation, March 1947 issue

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150 Watt Transmitter

(Continued from page 39)

It may be interesting to pass along an experiment carried out with a Bliley AX-2 crystal. The crystal was being used to double to 14,175 kc. (which used to be a good frequency). After the 'phone QRM became R9, however, it became desirable to QSY. The crystal was removed from its holder and coated on both sides with India ink.

The excess was blotted off with a single thickness of Scot-towel. After the ink was allowed to dry for a few minutes, the blank was polished by rubbing across the Scot-towel and re-assembled. It was found possible to drop the crystal frequency out of the

low end of the band! The blank was polished until only a discoloration remained, and the operating frequency was still 50 kc. lower! It seemed strange that the Scot-towel (no commercial intended) was apparently the only kind of paper which would give a satisfactory polish to the crystal. Other types tended to smear or streak the ink, even when dry.

As an outgrowth of the transmitter described, a larger rig, employing band-switching turrets and using two 829B's in push-pull parallel, modulated by two 829B's in push-pull parallel, is planned. The surplus tubes are on hand and "aching" to get into action. The cash outlay for the transmitter described was less than \$35.00. For 150 good watts, that's hard to beat!

—30—

FURTHER REDUCTION OF UNITS IN DECADE BOXES POSSIBLE

By R. C. WOODHEAD

FURTHER simplification of the decade boxes shown on page 100 of the January, 1947 issue of RADIO NEWS can be achieved if the constructor is willing to eliminate the tenth step on the decade, thus leaving steps 1 through 9 available.

Fig. 2A shows the wiring of a resistance decade which uses a two-deck switch and only four resistors. With the values indicated, the decade will provide integral values of resistance from 1 through 9 ohms. If each resistor value is multiplied by 10, the decade will be capable of measuring values from 10 through 90 ohms in steps of 10 ohms. Higher resistance decades may be secured by multiplying the resistor values by 100, 1000, etc.

The capacitance decade for using four capacitors with a two-deck switch is shown in Fig. 2B. Here again, higher capacitance decades may be designed by multiplying all four capacitance values by a suitable multiple of 10.

In both of these circuits, the switch arms are connected together. This permits a still further simplification if the constructor is willing to build his own switch equipped with a double-ended arm. Fig. 1 shows a resistance

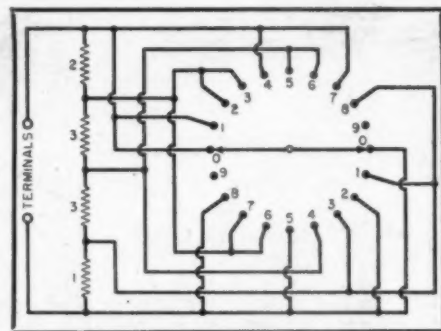


Fig. 1. Alternate arrangement for resistance decade. A single, two-arm switch is used.

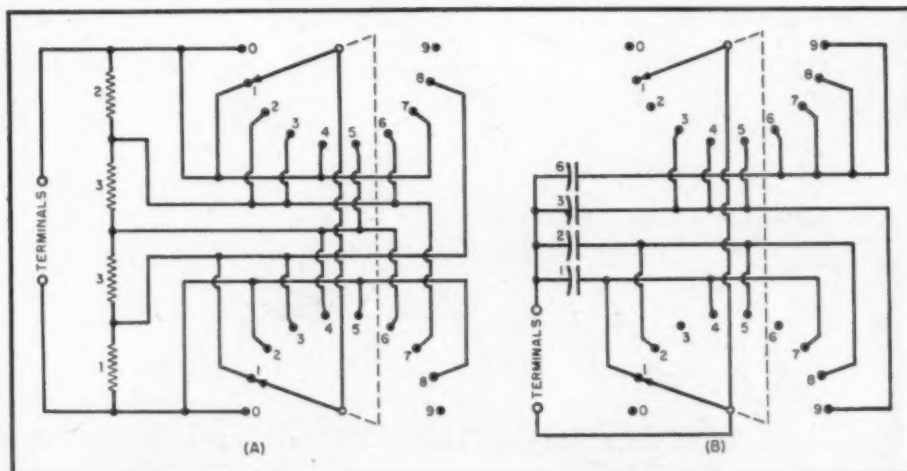
decade which uses such an arrangement.

For the low-range resistance decades, it is important that the resistance of the switch contacts be as low as possible and that fairly heavy wire be used. Distributed capacity must be kept low for a low-range capacitance decade.

By adopting these few suggestions, the physical size and complexity of the decade boxes may be reduced to a minimum.

—50—

Fig. 2. Wiring diagram of resistance and capacitance decade.



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Technical BOOKS

"AUTOMATIC RECORD CHANGERS SERVICING INFORMATION" compiled by M. N. Beitman. Published by Supreme Publications, Chicago. 144 pages. Price \$1.50.

A recently published book of interest to servicemen, this manual covers automatic record changers manufactured during the period 1945-47.

Included are exploded diagrams, top, bottom and side views, and line drawings covering the Admiral RC150 and RC160, Crosley Models K and SL, Detrola Models N-100 and N-200, Emerson #819003, Fada Model 205, General Electric Models P1 and P2, Motorola Models B-24-RC and B-25-RC, RCA Models RP, 960015, 960260-1 and 960260-2, Stewart Warner Models GI-502584 and W-504138, Wilcox-Gay Models 6B40B, 6B40M, 6B42M and 6B42W and Zenith Models S-11468 and S-11680.

Complete servicing information on each of these record changers is included and data on possible service faults, by symptoms, is provided.

"APPLIED PRACTICAL RADIO" by The Technical Staff of Coyne Electrical and Radio School. Published by Coyne Electrical and Radio School, Chicago. Three Volumes. Price \$9.75.

Well-written, easy-to-understand home study courses in radio are often hard to find, but this series of three texts should find wide acceptance among those whose working schedules do not permit full or part-time attendance at school.

These books have been carefully prepared to provide instruction for the layman and beginning serviceman who want to learn about radio either as a hobby or a profession. The textual material is clear and if the student takes up the course in orderly progression he should understand most of the essentials regarding radio and television by the time he has completed his studies.

The first volume deals with the basics such as electron flow, simple radio circuits, power and heat, conductors and insulators, switching and control, capacitors and capacitance, etc. The second volume is devoted to a discussion of frequencies, inductive reactance, resonance and tuning, coils and coil winding, tubes, rectifiers, oscillators, amplifiers, modulators, circuits, capacitance, transformers, etc. Finally, the third volume takes up such subjects as rectifiers, power supplies, wave radiation, antennas, amplifiers, superheterodyne receivers, auto radios, p.a. systems, high frequency, FM and FM receivers and television.

All of the volumes are well illustrated with photographs and diagrams and students should experience no difficulty in handling the material in these books.

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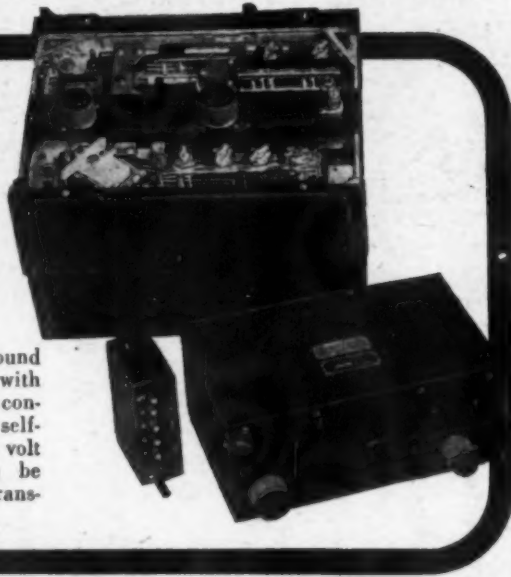
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Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

RECTIFIER APPLICATIONS

Of particular interest to engineers and servicemen is the new booklet just released by *Federal Telephone and Radio Corporation* covering twenty diversified applications for the company's rectifier plus data regarding the replacement of the rectifier tube in home radio receivers with the selenium rectifier.

This booklet is available upon request to *Federal Telephone and Radio Corporation*, 67 Broad Street, New York 4, New York.

CAPACITOR DATA

Engineering details on two new mica capacitors are given in loose-leaf sheet pages 30A and 30B just issued by *Aerovox Corporation*.

The Type 1690 mica capacitor is designed for use in u.h.f. circuits where it is essential to keep the minimum inductance of the circuit as low as possible. As a result of this requirement, the design lends itself to capacitors having very high external flash-over voltage. The Type 1780 water-cooled mica capacitor featured on the second page handles exceptional kva. ratings (up to 2000 kva.) for its size.

Amended engineering data on bakelite-case, temperature compensated Type 1570 mica capacitors is also available (pages 25 and 26).

Any or all of these data sheets may be secured by writing *Aerovox Corporation*, New Bedford, Massachusetts.

FLASHLIGHT GUIDE

Ray-O-Vac Company of Madison, Wisconsin is distributing copies of their "Flashlight Service Guide" to jobbers, dealers and other interested persons.

This six-panel, two color consumer information folder is written and illustrated for the layman. Information on the operation and component parts of the flashlight, proper maintenance and repair hints, and battery data is included in the booklet.

The guide is being offered free to the public in the company's advertisements while dealers may secure their supply of the guides through their wholesalers.

COMMUNICATIONS EQUIPMENT

Westinghouse Electric Corporation has just published a 44-page booklet which has been prepared to provide designers of communication and electronic equipment with a quick list of products available for their use.

Covering parts and materials for radio transmitters, radio receivers, radar, telephone apparatus, electronic

heating sets, and electronic controls, this booklet describes circuit breakers, electronic tubes, instruments, transformers, selenium rectifiers, general-purpose switches and relays, dynamotors, motors, blowers, etc. Application data, performance curves and charts for quick selection are included.

One section of the book, dealing with materials, discusses applications of Hipersil cores and other metals and alloys, Micarta, and industrial plastics and insulating materials.

Copies of the booklet (B-3610) may be secured from *Westinghouse Electric Corporation*, P.O. Box 868, Pittsburgh 30, Pa.

AIR TRIMMER FOLDER

North American Philips Company, Inc. is currently offering a four-page folder describing the *Norelco Air Trimmer*.

The text material describes the construction of the trimmer which consists of a stator having three concentric cylinders that slide in the spaces between the four concentric rings of the rotor.

Adapted particularly for manufacture of v.h.f., FM and television receivers, the folder points out that the new trimmer eliminates the "knee" in the capacitance curve.

Dimensional drawings and photos of the new trimmer are also shown in the folder.

Copies of this publication may be secured by writing *North American Philips Company, Inc.*, 100 East 42nd Street, New York 17, New York.

DU MONT BULLETIN

The function, description, block diagram, principal features, and specifications of the *Du Mont Type 280* cathode-ray oscillograph which is designed for television-studio facility and transmitter installations, are presented in Bulletin 690 just issued by *Allen B. Du Mont Laboratories, Inc.*

The instrument described in this bulletin provides a means for accurately determining duration and shape of various waveforms contained in the composite television signal and the character of the picture-signal video in conjunction with transmitter operation according to FCC standards and practices.

A copy of this bulletin will be sent on request to those associated with television who write on their business letterhead. Requests should be sent to *Allen B. Du Mont Laboratories, Inc.*, 2 Main Street, Passaic, New Jersey.

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Accurate a-c measurements .25 volt to 120 volts, 50 cycles to 300 megacycles.

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New unity gain d-c amplifier provides absolute stability with line voltage variations from 105 to 130 volts.

D-C Electronic amplifier ranges 3 to 1200 volts at 15 megohms, resistance ranges 3000 ohms to 3000 megohms.

Conventional 10,000 ohm per volt d-c ranges 3 to 1200 volts, 1000 ohm per volt a-c rectifier ranges 3 to 1200 volts.

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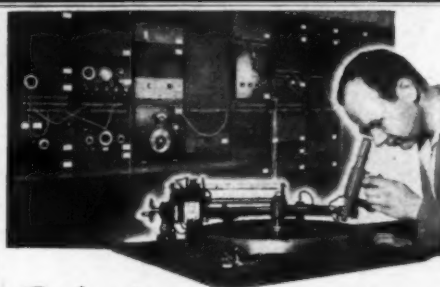
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(Continued from page 63)

use of a single i.f. stage has the advantages of simplicity, low cost and small space requirements. Since its single pentode amplifier tube provides sufficient amplification and its four tuned circuits (see Fig. 2) provide sufficient adjacent-channel selectivity and rejection of other spurious responses for such receivers, all important requirements of the i.f. amplifier are met.

In some receivers designed for special applications in which extreme selectivity is required, the selectivity problem alone often dictates the use of more than one i.f. amplifier stage in order to obtain the two additional tuned circuits (see Fig. 5) that are contributed by each additional stage. In others (television receivers, for example) the additional tuning circuits made available when more than a single i.f. amplifier stage is used are very helpful for obtaining certain special wide-band over-all i.f. response characteristics that are desired, as we shall see later. It would not be satisfactory to merely employ additional tuned circuits to a single-stage i.f. amplifier in order to obtain either greater selectivity or a desired over-all wide-band response characteristic, for the addition of each tuned circuit is accompanied by a decrease in the gain. Therefore more amplifier tubes are also necessary to maintain the desired over-all sensitivity.

When several stages are used in cascade, the over-all voltage gain is equal to the product of the gains of the individual stages. Thus, let us suppose that in the two-stage i.f. amplifier illustrated in Fig. 5 the frequency converter gain at the i.f. is about 10 times, the gain of the first i.f. amplifier stage is 50 times, and that of the second i.f. stage which feeds the diode detector is somewhat lower, say 40 times, because it is loaded by the diode input circuit. These gains are indicated on the circuit diagram. The resulting over-all gain at the intermediate frequency will then be $10 \times 50 \times 40 = 20,000$ times.

Similarly, the over-all selectivity may be approximated by multiplying the attenuations of the various stages at corresponding frequencies off resonance (off the middle of the pass-band). Of course, it is assumed that regeneration is kept at a minimum by sufficient bypassing and shielding.

When intermediate frequencies appreciably higher than about 600 kc. are used, it usually becomes necessary to employ several i.f. amplifier stages in preference to one because both the adjacent-channel selectivity and the maximum gain per stage obtainable decrease with increasing intermediate frequency. Consequently, here the added stages are used both for the additional gain which each added amplifier tube provides and for the added adjacent-channel selectivity contrib-

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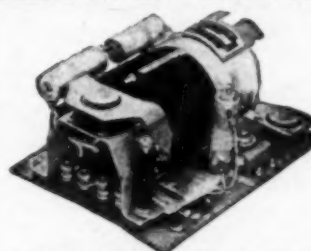
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uted by the two tuned circuits in each added stage. Thus, it will be found that FM broadcast band receivers, which employ a rather high i.f. in the neighborhood of 4.3 or 17.7 megacycles,¹ use two or more stages of i.f. amplification. In postwar television receivers, the use of two amplifier stages in the 21.25 mc. sound i.f. amplifier, and four stages in the 26.4 mc. video i.f. amplifier is fairly common practice. It is necessary to employ resistance-coupled, or resistance-loaded, transformer-coupled stages in the video i.f. amplifier in order to obtain the desired special wide-band over-all response characteristic required for the video signal. Amplifiers that employ such types of interstage coupling produce comparatively low gain per stage. That is why as many as four stages are required in the video i.f. amplifier to produce the required over-all gain.

A special advantage may be gained by the use of a multi-stage i.f. amplifier in a receiver where only one stage is actually needed to produce the required amount of i.f. amplification. By employing two low-gain stages in place of one high-gain stage, and applying the a.v.c. to the first stage only (or to the first stage and the mixer tube), modulation rise and distortion on strong signals may be very much reduced. Of course, this operating advantage is secured at the cost of the additional i.f. stage employed in the receiver.

Selectivity and Response Characteristics Required in I.F. Amplifiers

The selectivity and response characteristics desirable in the i.f. amplifier vary importantly with the class of signal to be received. This depends upon the class of service for which the receiver is to be used, i.e., whether it is to be employed for the reception of code, narrow-band speech in communications services, low-fidelity AM broadcasting, so-called high-fidelity AM broadcasting, high-fidelity FM broadcasting, television, or combinations of two or more of these.

In order to make clear what the requirements are in each class of receiver, the characteristics of the signal received in each of these classes of services will first be analyzed. When this is understood the bandpass characteristic desired in the i.f. amplifier, if it is to handle the signal with adequate selectivity and non-selective attenuation of important sidebands, will be readily apparent. Then, the amplifier can be designed to have essentially these desired characteristics.

Analysis of Amplitude Modulation

It will be recalled from the discussion of the mechanism of amplitude modulation presented in an earlier article of this series that during the process of amplitude modulation side-

¹ For a discussion of the factors that control the i.f. chosen and the i.f.'s now commonly employed in various classes of receivers, see Alfred A. Ghirardi, Practical Radio Course, Part 53 (RADIO NEWS, May 1947).



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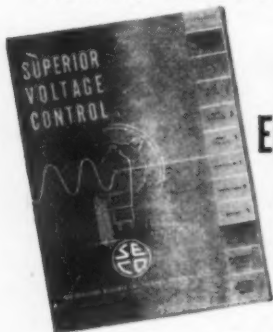
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band frequency components are produced. An analysis of the resulting modulated signal indicates that it consists of three components. The first component is the *carrier frequency*. The second and third components are the upper and lower *sideband* frequencies which are the particular part of the modulated wave that represents the intelligence being transmitted at the instant.

The instantaneous values of the pair of sideband frequencies produced are *greater* and *less* than the carrier frequency by an amount equal to the instantaneous modulating frequency. For example, if an AM transmitter having a carrier frequency of 1000 kc. is modulated by a single modulating frequency of 5 kc. and of sinusoidal waveform, a sideband component of frequency 5 kc. *above* the carrier frequency and one of frequency 5 kc. *below* the carrier frequency will be produced and radiated from the antenna. The relation of these two sideband frequencies to the carrier frequency is illustrated in Fig. 3A.

If the modulating source consists not of a single frequency but a number of frequencies ranging over the audio-frequency range, say from 100 cycles to 5000 cycles, an equal number of individual pairs of sideband frequencies will be produced over bands ranging to *greater* and *less* than the carrier frequency by an amount equal to this highest audio frequency, or ± 5 kc. In each case, the upper and lower sideband frequencies comprise the pair produced by an individual modulating frequency. Some of these pairs of sideband frequencies, bearing corresponding identification letters, are pictured in Fig. 3B. It will be observed that the *total* sideband width is equal, therefore, to *twice* the highest modulating audio frequency. In this case it is $2 \times 5 = 10$ kc., as indicated.

These salient features of amplitude modulation will be summarized here for convenient reference and for later comparison with the corresponding features of frequency modulation:

1. The amplitude of the AM transmitted wave, or the radiated power, is varied during modulation but its frequency is unchanged.
3. An increase in the frequency of the modulating voltage increases the

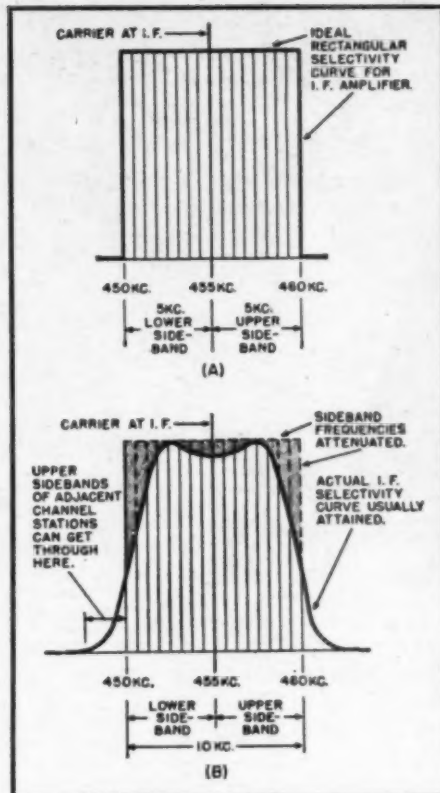


Fig. 6. (A) Ideal and actual over-all I.F. selectivity curves for low-fidelity AM receivers. The shaded area in (B) indicates the sideband components which have been attenuated.

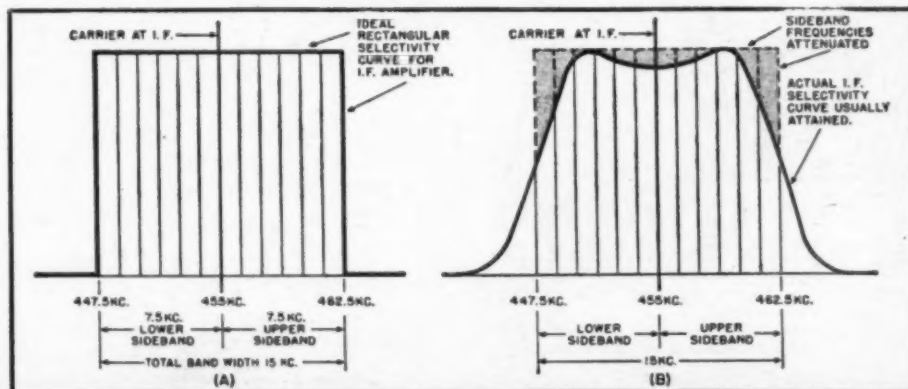
rate at which the amplitude of the transmitted wave is varied.

2. An increase in the amplitude of the modulating voltage causes the amplitude of the transmitted wave to vary over a wider range.

4. When subjected to amplitude modulation at a single modulating frequency of sinusoidal waveform, the AM transmitted wave becomes the sum of three components, a carrier identical in frequency with the unmodulated wave, and a pair of sideband components of frequencies above and below the carrier frequency by the amount of the modulation frequency.

5. Since only one pair of sidebands is produced for each modulating frequency during amplitude modulation, a bandwidth of twice the highest modulating frequency is sufficient for sat-

Fig. 7. (A) Ideal and actual over-all I.F. selectivity curves for high-fidelity AM receiver. The shaded areas (B) indicate attenuation of the sideband components.



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4 mf 300 vdc	.30	1 mf 1000 vdc	.75
4 mf 400 vdc	.50	1 mf 1000 vdc	.25
5-5 mf 400 vdc	1.05	2 mf 1000 vdc	.65
1 mf 500 vdc GE	.25	4 mf 1000 vdc	1.00
2 mf 550 vdc	.25	10 mf 1000 vdc	1.40
.25 mf 600 vdc	.20	1 mf 1500 vdc	.95
.85 mf 600 vdc	.25	4 mf 1500 vdc	.15
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SUPERHEYS	\$6.00
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Extra to go with ARC-5	
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Control Box	1.00
Drive Cable	2.50
Mounts	1.00
Double Mounting Rack	1.65
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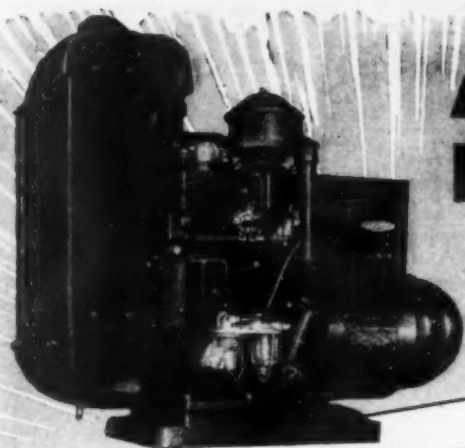
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isfactory passage of the amplitude-modulated wave under any degree of modulation.

Composition of Signal in Low-Fidelity AM Broadcasting

The signal that is radiated from the transmitter of a typical low-fidelity AM broadcast band transmitter has these characteristics. Partly because of limitations imposed by noise that accompanies AM transmission, the audio modulations transmitted from such stations are limited to an upper-frequency value of 5000 cycles (5 kc.). Consequently the radiated signal from each American AM broadcasting station consists of the carrier frequency and a whole series of upper and lower sideband frequencies extending to ± 5 kc. from the carrier frequency. This same type of signal exists at the receiver input and in all the r.f. circuits up to the grid of the frequency converter. Because of this ± 5 kc. bandwidth occupied by the signal from each station, the FCC allocates to such American transmitters carrier frequencies at least $2 \times 5 = 10$ kc. apart in order to avoid overlapping of signals.

Composition of Signal in I.F. Amplifier of Low-Fidelity AM Broadcast Receiver

In the output circuit of the frequency converter each of these frequency components appears transposed in frequency by the same amount. Thus, if the signal is on a carrier of 1000 kc. with sidebands up to ± 5 kc., and the i.f. employed in the receiver is 455 kc., it appears in the output circuit of the frequency converter as a 455 kc. signal with sidebands extending to ± 5 kc. above and below it. The signal and its sidebands are pictured in Fig. 4 both before and after frequency conversion takes place. Notice that the total width of the sidebands is not affected by the frequency-conversion process.

I.F. Selectivity Characteristic Required in Low-Fidelity AM Receivers

Since the i.f. carrier and its sideband frequencies should (theoretically) all proceed through the tuned circuits of the i.f. amplifier (see Figs. 1 and 2) without selective attenuation of any of them, a flat-topped bandpass response characteristic just wide enough to pass a band of frequencies $2 \times 5 = 10$ kc. wide with little or no selective attenuation of any of them is desired, if distortion of the signal here is to be avoided. It should attenuate very rapidly thereafter so as to reject possible signals of interfering stations in the adjacent transmission channels. The need for a flat-topped steep-sided bandpass selectivity or response curve of rectangular shape, just wide enough to admit the required i.f. carrier and its sidebands, but rejecting all other frequencies that may have come through the frequency converter is indicated. For the receiver being considered here this would mean a steep-sided rectangular band-

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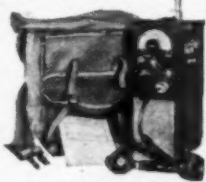
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SCR195 Walkie Talkies, brand new, weight 27 1/2 pounds including knapsack. Range up to 25 miles in open country. Frequency 52.8 to 65.8 MC. Transmitter and receiver with regular hand set. Complete ready to operate with spare parts.

Each

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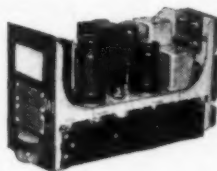
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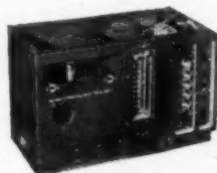
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Brand new servo amplifier containing two beam power output tubes (1632) similar to 25L6, two twin triodes (1633 and 1634) similar to 6SC7, two mica condensers, dozens of color coded half watt resistors, two dual and four section bathtub condensers, three transformers, two wafer switches, one volume control, four octal sockets. Easily convertible **\$3.95**



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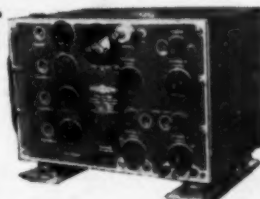
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100 WATT

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Four separate output tanks . . . One 4-position selector channel switch having seven sections which changes the ECO, IPA and output tanks simultaneously. All the controls are mounted on the front panel. The housing is cast aluminum; shields and case are sheet aluminum. Dimensions 11x12x15 inches, weight 35 1/4 lbs. Complete, simple instructions for conversion furnished. Complete with tubes... **\$49.95**



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extra set of coils... **\$2.95**

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Type No.	Secondary	Dimensions, Inches	Wt. Lbs.	List Price
FT-1	2.5 V.C.T.-3A	2 1/2" x 1 1/2" x 1 1/2"	3/4	\$2.70
FT-2	6.3 V.C.T.-1.2A	2 1/2" x 1 1/2" x 1 1/2"	3/4	2.70
FT-3	2.5 V.C.T.-6A	3 1/4" x 1 1/2" x 2"	1	3.00
FT-4	6.3 V.C.T.-2.5A	3 1/4" x 1 1/2" x 2"	1	3.25
FT-5	2.5 V.C.T.-10A	3 3/4" x 1 3/4" x 2 1/4"	1 1/2	3.25
FT-6	5 V.C.T.-3A	3 3/4" x 1 3/4" x 2 1/4"	1 1/2	3.25
FT-7	7.5 V.C.T.-3A	3 3/4" x 1 3/4" x 2 1/4"	1 1/2	3.25
FT-8	6.3 V.C.T.-6A	4 1/8" x 2 1/4" x 2 1/2"	2 1/2	6.00

FILTER AND AUDIO CHOKES

Type No.	Ind. Hys.	Current	Resistance Ohms	Dimensions, Ins.	Wt. Lbs.	List Price
R-14	8	40MA	250	2 1/2" x 1 1/2" x 1 1/2"	3/4	\$2.10
R-15	12	30MA	450	2 1/2" x 1 1/2" x 1 1/2"	3/4	2.10
R-16	15	30MA	600	2 1/2" x 1 1/2" x 1 1/2"	3/4	2.10
R-17	20	40MA	850	3 1/4" x 1 1/2" x 2"	1	2.80
R-18	8	80MA	250	3 1/4" x 1 1/2" x 2"	1	2.80
R-19	14	100MA	450	3 3/4" x 1 3/4" x 2 1/4"	1 1/2	3.90
R-20	7	160MA	100	4 1/8" x 2 1/4" x 2 1/2"	2 1/2	4.30
R-21	4/20	160MA	100	4 1/8" x 2 1/4" x 2 1/2"	2 1/2	4.30
R-22	120	5MA	4000	3 1/4" x 1 1/2" x 2"	1	3.90

CASE SIZES

Type No.	H	W	D	M	Wt. Lbs.
G-1	1 7/8"	2 1/4"	1 3/4"	2 3/8"	1
G-2	2 1/4"	3 3/8"	1 1/2"	2 7/8"	1 1/2
G-3	2 1/2"	3 3/4"	2-5/32"	3 1/4"	2
G-4	2 1/4"	4 1/8"	2 1/4"	3 5/8"	3



CLASS A INPUT TRANSFORMERS

Type No.	Application	Ratio	Case	Net Price
S-1	1 plate* to 1 grid	3 1/2:1	G-2	\$3.30
S-2	1 plate* to 2 grids	2:1	G-2	3.80
S-3	1 plate* to 1 or 2 grids compact type	4:1	G-1	3.10
S-4	1 plate* to 2 grids wide range response	1:1	G-3	5.20
S-5	Single or double button mike or line to 1 grid hum-bucking type	16:1	G-2	4.25
S-6	Single or double button mike or line to 1 grid, compact type	16:1	G-1	3.10
S-7	Single plate* and carbon mike to one or two grids	3:1	G-2	5.00

*Will match tubes like 56, 6C5, 6C6 triode, 77 triode, 37 etc. Can be used with high mu triodes with loss in low frequencies.

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Secondary Carries class C current
Any modulator tubes to any RF load. (See chart)

Type No.	Audio Power	Case	Net Price
S-18	12 watts	G-3	5.00
S-19	30 watts	G-4	7.50
S-20	55 watts	G-5	11.00
S-21	110 watts	G-7	15.50
S-22	250 watts	G-9	24.00

Other UTC series in stock at Universal include:
PA, VM, PVM, A, O, HA, HC, LVM, VI-C, LS.
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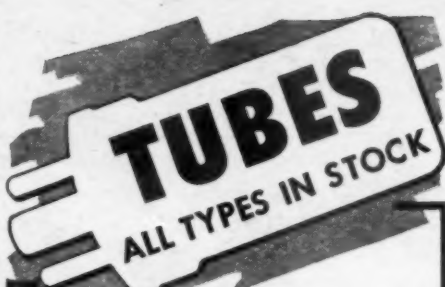
pass response characteristic with center frequency at 455 kc. (the nominal i.f.) and a total width of 10 kc., as illustrated in Fig. 6A. Since the selectivity characteristic is flat-topped, all the sideband components are admitted equally. Since it has straight steep sides any interfering signals from adjacent-channel stations are severely attenuated and reduced to inaudibility.

Such an ideal response curve can be approached, but not realized exactly in practice. The degree of realization is usually a compromise between cost and performance. The modified characteristic shown in Fig. 6B is illustrative of a typical practical characteristic realized in a commercial AM broadcast receiver. It is near enough to the rectangular bandpass characteristic in performance to satisfy most of the requirements of low-fidelity AM receivers. Observe that the extreme upper and lower sideband components of the desired signal are attenuated somewhat—also some of the mid-frequencies. This means that some audio distortion takes place since these modulation frequencies will not be present in their true amplitudes in the audio output of the receiver (unless proper correction for this characteristic is made in the audio system of the receiver). The somewhat rounded "skirts" of the response curve may allow the upper sideband frequencies of interfering strong adjacent-channel signals to get through (even though weakly), if any such signals are present.

The width of i.f. selectivity curve actually employed in practice is always controlled by both the actual width that is dictated by the character of the signal to be received, and by several other considerations. Not the least important of these are both the quality of reproduction to be attained, and possible interference by strong adjacent-channel transmitters.

I.F. Signal and Amplifier Response in Hi-Fi AM Receivers

Some AM broadcast band transmitters in the so-called "high-fidelity" classification were manufactured several years ago. These are designed to handle an audio-frequency range up to 7500 cycles. The ideal bandpass response characteristic of the i.f. amplifier in such receivers would extend to 7.5 kc. each side of the nominal intermediate frequency, when the receiver was switched to the Hi-Fi position. This is a total passband 15 kc. wide, as shown in Fig. 7A. It would then accept, without discriminatory attenuation, the sideband frequencies of the highest audio frequency that would be transmitted. It is apparent that the design of such an i.f. amplifier is somewhat more difficult and costly than one for low-fidelity AM broadcast reception. The type of i.f. response characteristic actually arrived at in practice is illustrated in Fig. 7B. Notice that it departs somewhat from the ideal in that its top is not absolutely flat, its sides slope somewhat,



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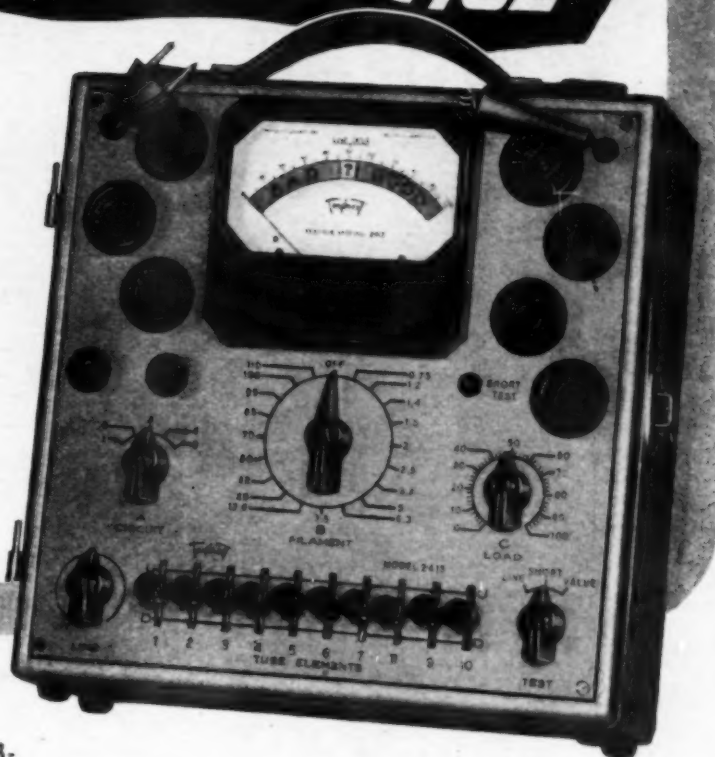
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and it has slightly rounded "skirts." Some sidebands are attenuated, but not sufficiently to seriously affect reproduction of the transmitted intelligence.

(To be continued)

Spot Radio News

(Continued from page 20)

ment, at least, little difficulty is anticipated in getting international agreement on frequencies. "The basic principles of the United States systems now in use," says Rear Admiral Earl E. Stone, chief of Naval Communications, "are sound and satisfactory for world-wide use." He added that while there is room for development in the marine field, radio and electronic equipment already tested should not become obsolete for many years, and should also meet requirements of all international conferees. Whether there will be objections to this view remains to be seen, but few are anticipated.

ENHANCING SAFETY in another field was a radio development late in the spring, with FCC's Radio Intelligence Division playing a leading role. It will be remembered as the radio detective network that ran down enemy stations during the war, usually in a matter of minutes after the aliens went on the air. The RID network now is available to lost planes, and has been coordinated with networks operated by the Coast Guard and Army, with a direct telephone hook-up with the Civil Aeronautics Administration's airways network. Pilots will notify any available CAA airway radio station if they are in trouble, giving frequencies on which the pilot can transmit. FCC and other networks will be immediately alerted and then the pilot will be told what frequency to use for his "long call." Within five minutes, he will be given a good fix, according to estimates of the experts who have set up the service, but if we know our RID, most of the time the fix should come through in a much shorter time.

AVIATION, if you don't already know it, has become a big customer in the radio field. Next to hams, FCC announced recently, aviation now is the largest single radio group under Commission license. Total aviation stations are approximately 15,000, and 13,000 of these are in cockpits. In an effort to streamline licensing and checking these stations, FCC has consulted government, business, and private interests. Result, early this summer, was a new set of regulations, making it possible to get a license through FCC-designated CAA representatives. The application form has also been simplified. On the other hand, don't expect miracles from the Federal bureaucracy. The streamlined rules and regulations cover both sides of 32 single-spaced, typewritten 8½ x 11 pages.

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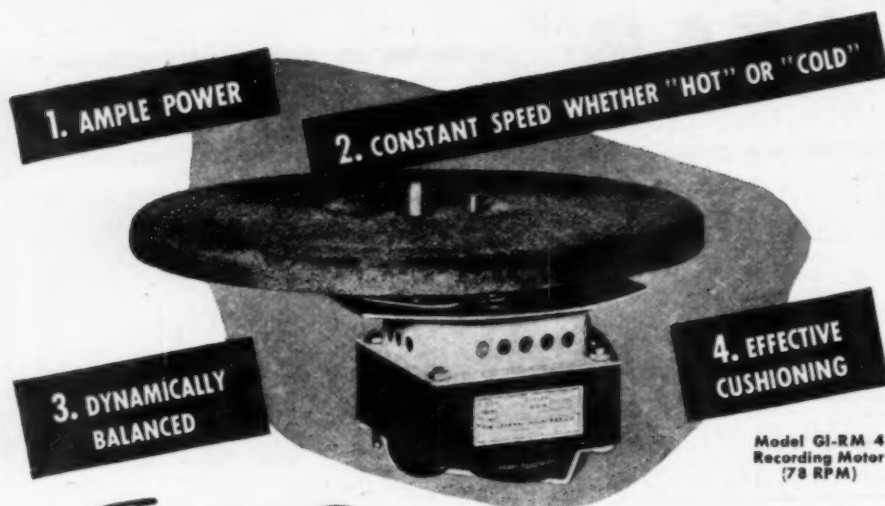


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Practical Microwaves

(Continued from page 37)

Circuits comparable to that previously known and used on lower frequencies. Any modifications should be towards simplicity by reduction of components. Preference should be given to tubes that are conventional or produced in sufficient volume to assure reasonable cost. Quarter wave phenomena should be recognized and utilized wherever possible as will be the case for wave guides and cavities to replace other transmission lines and tuned circuits. Circuits should be simple with a minimum number of parts which cause complex conditions. Parts should include only those necessary for correct phasing of the circuit on the desired frequency. Parts should be of such dimensions and should be so placed on the chassis that they will have the correct wave guide, cavity and other circuit effects needed for the utilization and frequency desired.

14. Are special tubes necessary?

Magnetrons and klystrons are two types of tubes heretofore widely used on microwaves. The "Lighthouse" or disc-seal type also functions on microwaves but becomes impracticable beyond about 4000 megacycles. The author has preferred to concentrate on the use of mass produced conventional receiving and transmitting tubes universally available and low in cost. He is accomplishing this on u.h.f. and s.h.f. by making the transit time equal to any required number of periods of oscillation. Developments have reached a point where it will be soon possible to describe it to the radio public interested in microwaves.

15. What features in microwave equipment make it possible to obtain maximum efficiency with minimum transmitter power?

Transmitter power may be reduced, even down to some low order such as a milliwatt, depending on how many of the following advantages or aids are provided:

(a). Keeping transmitter at or very close to the antenna so that very little transmission line is used and very little energy is lost in transferring energy from the transmitter to free space.

(b). Using wave guide or coaxial cable having the lowest possible loss per unit length.

(c). Having either a clear unobstructed horizon or obstructions of such location, dimension, contour and composition that it can reflect energy striking it in useful directions.

(d). By utilizing arrays or reflectors that concentrate the energy fed to the antenna and sending it out in a narrow beam instead of being diffused in every angle of a sphere. Similarly at the receiving point, such arrays or reflectors should pick up the energy of a relatively large region in free space and focus it on the antenna dipole. This gain may be anything higher than unity. On super high frequencies it

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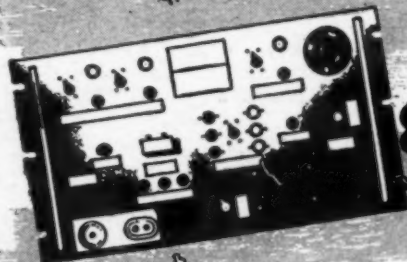
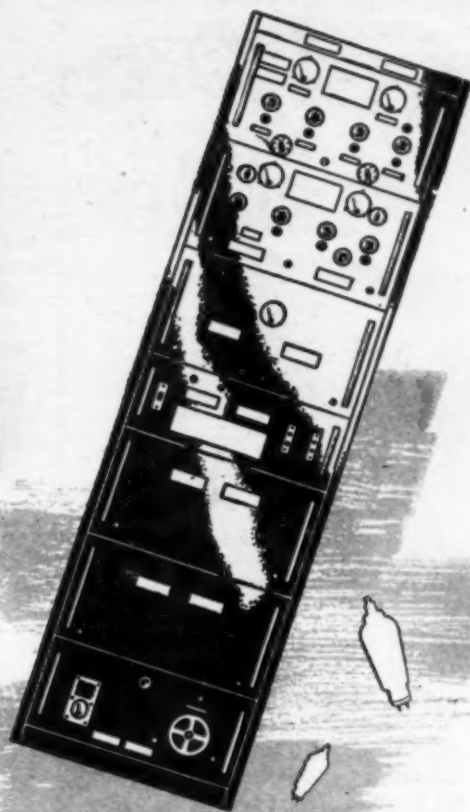
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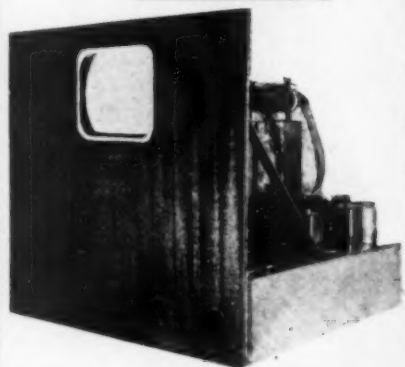


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may be anything the station owner cares to provide. Gains of 1000 at each end (total 1,000,000) are feasible on frequencies exceeding 3000 megacycles. Gains of 10,000 at each end can be achieved on frequencies exceeding 10,000 megacycles (total 100,000,000 times).

(e). Keeping the receiver close to the receiving antenna to minimize losses in transferring energy from antenna to receiver.

(f). Using coaxial cable or wave guide having minimum loss per unit length at the receiving station.

(g). Using a receiver of high sensitivity. Receivers for very high frequencies that can function on signals of .2 microvolt or a trifle less already exist. Microwave receivers have not yet attained such high sensitivity in practice. However sensitivities in the order of 2 microvolts or less have been attained. This should be sufficient for horizon communication even with low transmitter power.

(h). Using a receiver sufficiently selective or sharp in tuning so it covers little more than the bandwidth represented by the incoming signal. There is no sense in picking up the noise of 1000 kilocycles bandpass when the transmitted signal only occupies about 100 kilocycles. The less noise picked up with the signal, the more amplification may be used in the receiver for an understandable signal. This is equivalent to a tremendous increase in transmitter power. Receivers should have no more circuits than necessary. Additional circuits and tubes means more skin losses, more dielectric losses, more thermal noise in the tubes and circuits, etc., provided however, this is not achieved by driving each tube too hard.

(i). Making sure that the antenna dipole is at the correct focal point for a given reflector dimension or array. This will differ with each frequency or wavelength. It is comparable with the correct positioning of the bulb and the filaments within the bulb for an automobile headlight. If a headlight beam is depressed it hits the earth sooner. If beam is raised it reaches out much further. If raised too high, it will be lost in undesired direction. The smaller the wavelength or higher the frequency, then the closer can a dipole's quarter wavelengths approach the dimension of a pin point which, in the final analysis, is the only true focal point.

(j). Correct polarization. The receiver antenna dipole must be at the correct angle for the incoming energy. If there was nothing enroute to change the angle of the wave fronts, then the receiver antenna dipole could be at the same angle as at transmitting point. However, if the energy hits the earth or obstructions enroute, it may undergo a change of polarization or angle. Unless the receiver antenna dipole is correct for it, much energy which otherwise could be available is lost. This may not be readily apparent to the user of the equipment since

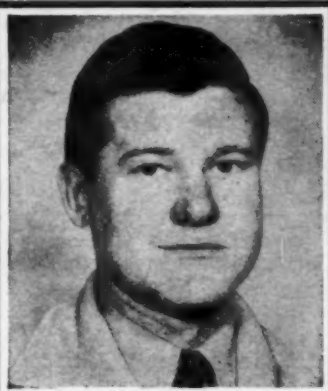
enough may remain for satisfactory communication. Antenna research conducted by the author even on low frequencies indicate that gains as much as 100 times are possible if the receiver antenna is correct in angle for an incoming signal. It may be inconvenient to try and keep it constantly correct but where it is convenient to do so, it is a most valuable advantage in providing more range and signal strength. This will hold true on any frequency whether microwaves or not.

(k). In the case where both stations are fixed or stationary, do not lock their locations until it has been determined they are spotted at their maxims with respect to each other.

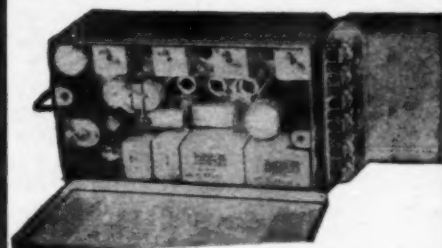
(l). Take advantage of antenna elevation so that no energy, or as little as possible, diverges to strike the earth where it is absorbed in some degree or produces a change in polarization, direction or unfavorable phase relationship. By whatever amount the transmitting and/or receiving antenna locations are elevated, then the square of that amount of range and/or signal strength will be available. It is the simplest and cheapest way of raising signal strength and increasing the range. Antennas require no tubes, electric power or constant expense as an increase in transmitter power might otherwise require. In the final analysis all the power in the world cannot increase the range beyond the horizon, while a small increase in antenna height does. The power falls off much faster than the inverse square of the distance beyond the horizon. It becomes more like a logarithmic increase in the loss of power when it is necessary to penetrate beyond the horizon by direct means.

(m). Using optimum values of Q . Within practical limits, the highest order of Q in a circuit is desired. On microwaves it is possible to provide without inconvenience, values of Q in the order of 25,000. This compares with less than 100 on lower frequencies. High values of Q are obtained when the a.c. reactance of a circuit is much greater than the a.c. resistance of the same circuit. The a.c. resistance increases as the frequency is increased due to skin effect. The a.c. resistance at the same time decreases because at higher frequencies, coils have less turns and all conductors in general are shorter in length. When energy oscillates back and forth in a circuit, it diminishes in strength due to the a.c. resistance present. As the frequency increases, the total losses of the circuit increase. In a microwave circuit the a.c. reactance may approach an infinite value while the a.c. resistance may be a very small value with respect to conventional lower radio frequencies. The ratio between the a.c. reactance and the a.c. resistance of a circuit is called the Q .

The higher the Q , then the sharper or more selective will a signal be both at the transmitting and receiving points. It means minimum channel occupancy and very selective and



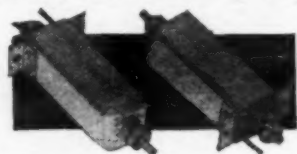
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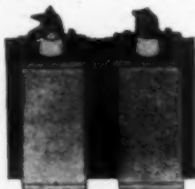
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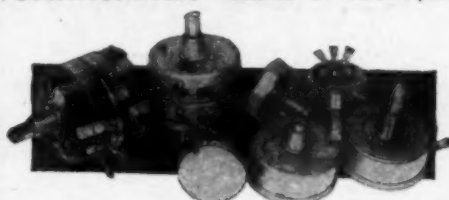
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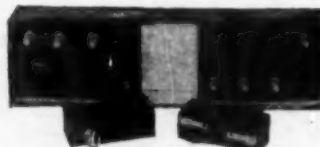
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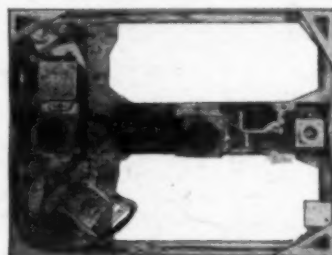
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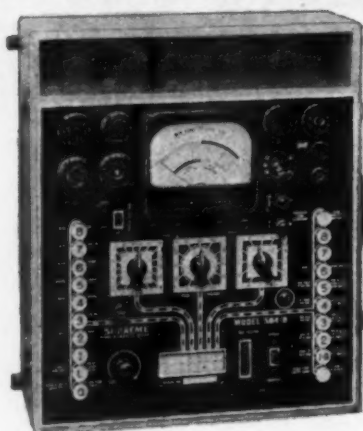
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therefore sensitive receivers. At the transmitter it also means that the total energy is concentrated into a narrower amount of frequency spectrum. All this serves to increase the over-all efficiency.

(n). Although high Q and selective receivers have been mentioned, it can be overdone. For example, some leeway should be provided at the receiver in case the transmitter frequency should deviate or the receiver frequency response change small amounts. This might occur due to voltage variations in the power energizing equipment at either end. It may also vary because of temperature changes at either point. These amounts are not too great but should be taken into consideration.

The author has always been on the alert for reports on microwaves which would indicate that they are unfavorable with respect to very-high frequencies for two-way radio communication. When these reports are largely academic rather than based on practical tests, he is prone to feel that such determinations may be incorrect since it is possible to overlook unknown but actually highly relevant factors. Where the report has been based on actual tests in the field, the locale and conditions have been studied to determine whether it is based on conditions and circumstances that are freakish or highly abnormal or subnormal with respect to conditions as they exist in our everyday lives and locales. Also it has been studied to determine whether it has been based on unobstructed natural horizons or whether it took place where obstructions were unfavorable for forward reflections.

The author has been particularly interested in comparing the range and signal strength of the famous "handie-talkie" operating on 3000 to 6000 kilocycles with ultra-high frequencies. Using a 6N7 tube on the lowest microwave amateur band, he has been able to communicate several times the range of such equipment. A typical mobile case was 1½ miles for the "handie-talkie" as compared to 6 miles for the u.h.f. equipment. —50—

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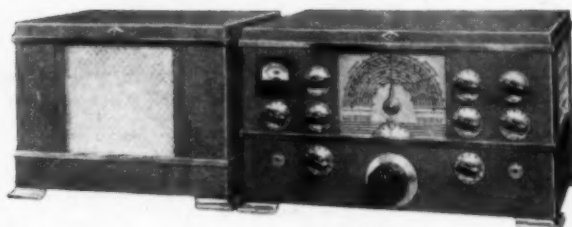
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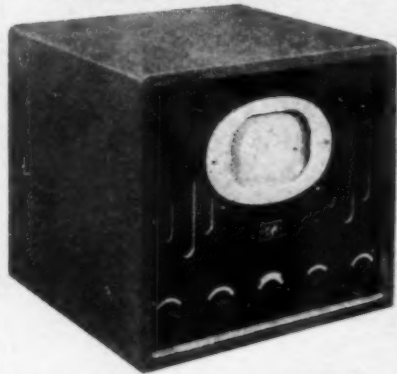
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Quotations on larger quantities furnished upon request

USEFUL FOR: ★ AC-DC Portables ★ Intercom Power Supplies ★ Console Radios ★ Replaces 29 Types of Rect. Tubes.

KN-9524—Transformer Pri. 115 V—60 cycles. Sec. #1—450 V @ 30 MA C.T.; Sec. #2—6.4 V. @ 1250MA. Rectangular metal case, stud mtg. solder eyes—approx. size 3 1/16 x 2 5/16 x 3 3/8 with stand-off 4 1/8.

No. T2G-97. Special \$1.95

I.R. #7313 Filament Trans. 115 V—50-60 cycle. Sec. #1—27 V @ 4.3 amps. No. C.T.—Sec. #2—5.1 V @ 3 amp C.T.; Sec. #3—6.4 V. @ 3 amp No. C.T.—Sec. #4 5.1 V. @ 2 amp C.T.—Sec. #5—2.6 V. @ 3.5 amps No. C.T.—Rectangular metal case, solder post terminals; Mid on porcelain stand-offs; stud mtg. size 5 1/8 x 4 1/8 x 5 1/8 with standoffs 6 1/8.

T2E-88. Special \$4.95

NEW No. 631PI/SNA Glass Strobrotion tubes. Each \$3.25
100 By-Pass Condensers, 10 Varieties. Special. \$4.95

High voltage transformer with Glass Standoffs. Pri. 115 V. A.C.—400 cycle—Sec. 13,500 V. Rectangular; approx. size 6 1/8 x 4 1/8 x 3 3/8 with standoff 7 1/8—13 Mills D.C.

T3F-7. Special \$3.95

TUBE

12A6	.83	6SN7	.70
6SQ7	.83	6517	.83
6AJ5	1.25	6C4	.79
1625	.70	5F81	6.95

All Prices FOB New York City, N. Y.

**HIGHBRIDGE RADIO-TELEVISION
& APPLIANCE CO.**

343 CANAL NEW YORK 13, NEW YORK

Customer Never Buys

(Continued from page 40)

While we are on the subject of phone and address *never, never* over-estimate yourself to the extent that your ad carries no phone or address. Don't figure that people will look you up in the phone directory. They just won't bother! They will use another shop whose ad carries the necessary information for easy contact. Your old customers won't always supply you with enough business. Go *after* their business too.

Here's another suggestion along the line of address. One advertiser runs not only his address, but also uses a line "Just next door to the King Theater." He figures, and rightly so, that the theater is one of the best known spots in town. That is good advertising. Think from the customers viewpoint . . . make yourself easy to find.

Fig. 1 illustrates an ad that appears every other day in the classified columns. It keeps two servicemen doing all they have time to do. Wouldn't you call it a "What your customer buys" ad?

This ad occupies the same space as the one illustrated previously. I haven't examined the books, but I would estimate that these two companies do the same volume of business, but the one whose ad appears in Fig. 1 incurs just half the advertising expense.

Let's go over this ad with the view of analyzing it as we did before.

"Your radio will 'sing' again" . . . that's bringing the radio service right into the customer's line of thinking, isn't it? Notice that "Your radio" . . . not John Jones' radio but "Your radio." Make your ads, your merchandising, your selling *personal*. Since you can't call every customer by name in your advertising, do the next best thing. Use "yours," "your" and "you" whenever possible. It's no lie at all, that the pleasantest sound in the world to a man, is his own name. Use words that will be as close to that name as possible.

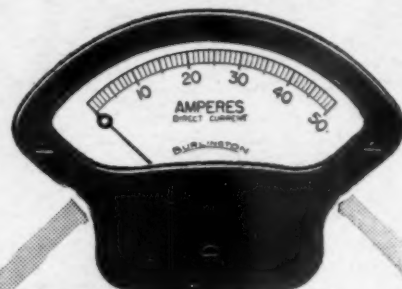
"Sing" may not sound like the right term to use, but isn't that term a bit more striking than "operate, play or work?" Make your words put pictures in your customers' minds.

Next the line "When your radio doesn't sound the way you want it to." Not the best grammatical construction, but once again, we have a good clear, *personal* expression. This ad doesn't say when your radio doesn't sound right, but "When your radio doesn't sound the way you want it to." Keep that personal touch in at every possible opportunity.

"Bring it to us or call us." Make the customer realize how easy it is to get his radio "singing" again. It won't hurt your drop-in trade to inform your customers that you operate a pickup and delivery service.

"It'll sing like new, when we bring it back to you." "Like new" . . . that's

- RUGGED
- DEPENDABLE
- ACCURATE



Burlington
PANEL

INSTRUMENTS

For utmost reliability—specify and depend upon Burlington Panel Instruments. They are designed, engineered and built to give satisfactory service even under most severe applications—and are fully guaranteed for one year against defects in material or workmanship.

Write today for full details

**BURLINGTON INSTRUMENT
COMPANY**

915 Fourth Street

BURLINGTON IOWA

ELECTRONIC COMPONENTS

Socket for 5CP1 & 3BP1. \$0.90
New 5CP1 shields with bracket & ground pins, cad. plated (3-lbs.). 1.25

NEW TUBES

954 Acorns 75c	9002 85c
956 Acorns 75c	1625 75c
957 Acorns 75c	
1U5 miniature det. pent.79	
32L7 GT Rect. & Beam P. amp. 1.25	
New National ceramic acorn sockets 35c each.	
4 for 1.00	
Weston 2 1/2" 0-1ma. D.C. grad. in 0-10 output units 4 1/2" x 1 1/2" wood case. 3.50	
Westinghouse 4 1/2" dia. 0-150 D.C. Voltmeter. 5.50	
Westinghouse 4 1/2" dia. 0-20 D.C. Milliammeter. 4.95	
Miniature 1 1/2" wave selenium rect. 18v. 1/2-1ma. 1.00	
3 for50	
Matched pairs bel. rect. for meters 1/2-1ma.50	
2 for50	
100 ft. spaghettil 1/8" HV cambric, 1/2 plastic (1-lb.) 1.00	
12-18v elect. controlled carbon pile voltage regulator95	
115/15v-3A. 1.4-2A & 230/30v-3A. 2.8v-2A. 60 cyc. 50 watt herm. sealed xformer, black crinkle (4-lbs.) 1.25	
Choke, 10 henry, 75 ma. 260 ohms, herm. sealed (3-lbs.)98	
Blocking oscillator transformers, herm. sealed (3-lbs.) 1.25	
New Dynamotor 12v to 250v DC 50 ma (4-lbs.) 2.50	
New Dynamotors 24v DC to 240v DC 30 ma (6-lbs.) 1.95	
New Dynamotors 24v DC to 450v DC 200 ma (11-lbs.) 4.25	
Relays 24v DC DPDT 10 amp. contacts.85	
Heavy duty Sig. Corps telegraph key, sil. cont. & switch89	
Wired Ampl. chassis 3"x7"x2", 2-2 sockets, pot., resistors, condensers.75	
Balantine microphone amplifiers less 7P7 & 59 tubes (5-lbs.), has 2 mike jacks. 2.50	
Heavy punched Al. chassis 3 1/2"x4 3/4"x6 1/2" (3-lbs.) 3 for95	
Heavy punched Al. Chas. 2"x6 1/2"x7 1/2" 5 soc. (3-lbs.) 3 for 1.25	
Octal ceramic ring sockets fits above chas. (1-lb.) 10 for 1.00	
200 squeeze-on term. lugs for 10-22 ga. wire (1-lb.) 1.00	
Squeeze-on terminal tool and cutter, (1-lb.) 1.65	
200 silver plated soldering posts for term. boards (1-lb.) 1.00	
25 pieces 1/4"x3/8"x5/16" linen bakelite. 1.25	
25 pieces 1/4"x3/8"x11" bakelite. 1.65	
25 pieces 1/4"x3/8"x1 1/2"x10 1/2"x11" 2.65	
5 lb. kit ass. 1/4" linen bakelite 2"x10"; 4"x5" (6-lbs.) 1.95	
2 lb. kit ass. 1/4" linen bakelite (3-lbs.).95	
Cardwell 365 mfd. single section var. cond. (1-lb.) 1.65	
2 gang ball bearing. 365 mfd. per section (1-lb.) 1.75	
Relays 115v/60cy. transm. & recv. (11-lbs.) 2 for 8.50	
G.E. 37.0v/400 cy. differential generators (adds substrs electrical angles) (3-lbs.) each. 2.00	
RG-34 U. 72 ohm Co-w 24" lengths handles 2Kw., 6.5 cents per foot.	
Antenna, Osc. R.F. & peaking coils, kit of 10 (1-lb.)95	
Metal tool pouch 7"x4"x1 1/2" hooks on belt. 25c (3-lb. each) 4 for 1.00	
20% deposit required on all C.O.D. orders.	

OHMEYER ENGINEERING LABS.

Fairview Blvd. Dept. C Hempstead, N. Y.

Belltone
TRUE FM

TELEVISION

KIT

**EVERYTHING
COMPLETE and
Ready to Assemble**

\$159⁵⁰

including complete
**DIAGRAMS AND
INSTRUCTIONS**
large and easy to follow
**CHASSIS AND FRONT
PANEL INCLUDED**

**26 SQ. INCH PICTURE!
6 CHANNELS!
17 TUBES!..**

including 7" Dumont Cathode
Ray Picture Tube
OPERATES ON 110 VOLTS
50-60 CYCLE
SINGLE PHASE A.C.



MODEL 500-T

Here is the finest TELEVISION kit ever offered at ANY price... yet THIS price is LOW... and you'll see HOW LOW when you examine the many HIGH-QUALITY features. It's TRUE FM sound, with exceptionally brilliant vision. The kit can easily be constructed by ANYONE who can follow a radio circuit diagram. Hundreds have already been assembled by radio students and are in continuous operation. No holes to drill. Completely punched and drilled 17" x 15" x 4" chassis and front panel supplied. This is a wonderful opportunity for you to own a GOOD television receiver. The sooner you send your order, the sooner you can begin enjoying Belltone television reception.

USE THIS ORDER COUPON ▶

F. O. B. New York City

BELLTONE RADIO & TELEVISION CORP.
583 Avenue of the Americas, New York 11, N. Y.

CHECK THIS LIST OF QUALITY FEATURES

- ★ 3.5 MC bandwidth giving beautiful picture definition.
- ★ 25.75 MC trap-tuned, high gain video I.F. transformers.
- ★ Exclusive TRUE FM sound circuit. We DO NOT use slope detection.
- ★ 3 stages of video I.F. amplification. 2 stages of video amplification.
- ★ Extremely stable hold circuits.
- ★ Includes 17 tubes (counting 7" Dumont cathode ray tube.)

BELLTONE RADIO & TELEVISION CORP. 583 Ave. of the Americas, New York 11

Please send....BELLTONE TELEVISION KITS, @ \$159.50 ea.

☐ Check or ☐ Money Order Enclosed

NAME _____

STREET _____

CITY _____

STATE _____

ENCLY



TELEVISION KIT... A High Quality TELEVISION RECEIVER

ready for Easy,
Rapid Assembly

Features the Brilliant
LECTROVISION Picture Tube!

ENGINEERED
BY
TELEVISION
SPECIALISTS



Easy-to-Assemble: No knowledge of television required. COMPLETE easy-to-follow INSTRUCTION SHEET gives you all the knowledge you need.

This Kit INCLUDES SOUND, all component parts, and the following:—

Specially designed Television Antenna . . . A \$30.00 Brilliant LECTROVISION seven-inch Picture Tube, plus ALL other tubes . . . Pre-tuned R-F unit . . . Finished front panel . . . All solder, wire, and 60 ft. of low loss lead-in cable.

Operates on 110V.; 50-60 cycles A.C. Price: complete with ALL tubes, \$159.50 (fair traded)

IMMEDIATE DELIVERY!

We believe that the comparative quality of this set is superior to other available sets. It has been acclaimed by major television schools.



CABINET for TRANSVISION Television Kit

Made of selected grain wood, with beautiful hand-rubbed walnut finish. Labeled knobs. Overall size: 17 1/8" deep, 19 1/4" wide; 15 3/8" high. Price: \$29.95

DEALERS! Cash in on this Kit! Ideal for making your own Custom-Built Television Receiver. See your local distributor, or for further information write to:

TRANSVISION, INC. Dept. R. N.
385 North Ave. New Rochelle, N. Y.

a good expression We all like "new" things don't we? "When we bring it back to you" is repetition of the delivery idea.

Address and Phone . . . remember, be easy for your customer to reach.

No ad is perfect. As additions to this ad, wouldn't it be a good idea to mention the speed of your service? Also if Smith's Radio Service handles "Electronic Radios," wouldn't it be smart to plug those sets?

Another type of ad, which produces results is illustrated in Fig. 2.

This ad runs as a two-column, three-inch ad, once a week and uses a small picture of a serviceman digging into the vitals of a receiver.

The picture idea in an ad is a good one. Pictures definitely add to the "eye-appeal" of an advertisement. This particular picture in this particular ad is especially good since it illustrates more clearly what the ad is about than the headline.

The headline "Electronic Servicing" may seem an ideal expression in this "Electronic-Atomic Age" However, there are lots of people who have associated the word "Servicing" with radio repair. There are many more who don't have an idea in the world what "Electronic" means. Terms that people don't understand (in your author's opinion) have no place in advertising. As proof of this theory take sales mottos for nationally advertised products. How many of them use words as complex as "Electronic Servicing"?

"Your faulty radio" . . . serves as a personal expression, although faulty doesn't seem too proper a term to describe a radio that has "gone wrong."

"Skilled technicians" . . . in these postwar days, is coming into common use but a more down-to-earth term wouldn't be out of line here. Electronic equipment falls into the same classification. Use every-day words, and you'll strike a familiar chord with the multitudes.

"Just pick up your telephone and call 88745 for prompt pickup and delivery service." Particularly good words here are "just" and "prompt."

"Wizz Bang radios" . . . a plug for the radios you have to sell. Associate all of your services and products as much as possible.

Address and Phone just as important as ever.

There is a tendency for well-established servicemen to rest on their laurels, forgetting or ignoring advertising and selling. Although in some rare cases this may be all right, as a general rule, it is to be avoided.

At this point, your author would like to give a few particular suggestions to new men in the field.

Here is a good idea that has been used by old, well-established service and sales shops. It consists of applying a printed gum-sticker to every set that enters and leaves your shop. This sticker tells your name, address, and phone. It should be applied on the back of the sets, on the loop-antenna, chassis or cabinet. It's good for lots

of repeat customers . . . if the service was satisfactory in the first place. If the service was not up to "snuff," the sticker may boomerang on you and drive customers away. No amount of advertising, stickers, or selling will sell poor service.

We have covered just a few important principles of selling radios and radio service through newspaper advertising and personal contact. Here are those principles once again.

For best results:

1. Think in terms of "What the Customer Buys."
2. Make reaching you as easy as possible . . . list phone and location.
3. Make your advertising and your service personal.
4. Publicize as fully as possible your services. Speed . . . Variety . . . Accuracy . . . Pickup and Delivery.
5. Start now! Even though you may have to "squeeze in" the time to do it.

-30-

88-108 mc. Tuner (Continued from page 43)

After the i.f. amplifier has been aligned it should be possible to hear signals with an antenna connected. Many of the FM stations broadcast during the late afternoon and evening hours only. The r.f. circuits should be aligned next. The tuning eye can be used as a convenient indicator. The tracking and frequency range covered is adjusted by compressing or spreading the turns of the oscillator coil and by setting the oscillator trimmer at the low frequency end of the band. The other trimmer condensers are set at the high frequency end of the tuning range. Since the frequency range covered (88-108 mc.) is a small fraction of the operating frequency it is easier to get the circuits to track satisfactorily. A simple way to check tracking is to notice the change in noise level of the receiver as it goes through its frequency range. If the level has peaks it is an indication of tracking difficulties. Should the 6SB7Y tend to oscillate at the signal frequency, insert a 3 ohm non-inductive resistor at the grid #3 terminal of the tube.

The antenna used on the model consisted of a folded dipole made from Amphenol 300 ohm twin lead with the line used as a lead-in. The folded dipole was made by cutting the twin lead down the center and folding it around a 3/4" square, 57" long piece of wood. Small porcelain standoffs were used to insulate the wire from the wood. Aluminum tubing may be more convenient and can be used for the dipole elements if desired. The overall length of the antenna can be calculated by the use of the formula: Length (feet) = 955/freq. (in mc.); or, Length (inches) = 11460/freq. (in mc.).

The length of a simple dipole would be: Length (feet) = 462/freq. (in mc.); or, Length (inches) = 5584/freq. (in mc.). The antenna should be cut for the center of the frequency range to be covered. In this case it would be 98

RADIO NEWS

SPECIAL VALUES ... for immediate delivery!

CONDENSERS

Cat. No.	Cap. MFD.	Working Volts	Your Cost
C110.....	1.....	5000 Oil.....	\$ 3.95
C111.....	3.....	4000 Oil.....	\$ 4.95
C112.....	1.....	1000 Oil.....	44c
C114.....	6.....	600 Oil.....	95c
C115.....	2.....	600 Oil.....	49c
Westinghouse 1 MFD 6000 volts WVDC \$7.95			
Westinghouse 1 MFD 10,000 volts WVDC \$12.95			
General Electric 25 MFD photo flash pyranol capacitor, 2000 VDC—INT.....			
144 MC. Radar Osc. uses 15E or with 3000, 7500, 23, 750 ohms. Brand new			
variable coupling. Complete test tube \$ 3.95			
Thordarson 300MA Power Transformer			
110 or 220 V 60 cy. input. Secondary:			
550 ct/550 tapped at 450/450 Extra			
bias winding 200 ct/100 at 50ma. 18			
lbs.....			
BC 1918 less tubes and tuning units.....			
\$14.95			
SV Filament Transformer 60 amps. 22			
lbs.....			
\$ 5.95			
Ear Phones. 2000 ohms, used—in good			
condition.....			
95c			
Ass't resistors 1/2 watt fully insulated, in			
popular ohmage. Cat. No. R-5 per 100 \$ 1.49			



NEW BC 223 AX TRANSMITTER

801 Oscillator and 801 Power Amplifiers, 2-46 Modulators and 1-46 Speech Amplifier 4 Xial Frequencies and Master Oscillator on selector switch. 10 to 30 watts output. Tone Voice or C.W. Mod. Ideal for 80 meter band. Comes with 3 coils TU 17A 2000-3000 Kc. TU 18 3000-4500 Kc. TU 25 3500-5250 Kc. Black wrinkle case. Includes 2 separate cases to store extra coils. Frequencies chart and tubes included, packed in original cases, less crystals at this low price. Cat. No. MT-100... Shipping weight 125 lbs.

\$29.95

MICA CAPACITOR
0.02 MFD 3000 VDC.
Cat. No. RT-101.....

49c

IF TRANSFORMER
Mounted in aluminum shield can
1500 KC, with air trimmer,
impedance coupled type.....

95c

30 MC IF Transformer
In square aluminum
can, silver slug tuned.....

29c



PHOTO FLASH TUBE
12,000,000 lumens light output.
Ignition coil included.
10,000 Flashes. Dia-
grams turn on request.....

\$8.95

FILAMENT TRANSFORMER

Thordarson Pri. 110 V 60 cy.—Sec. 6, 3V, 6A, CT. Cat. No. FT12.....

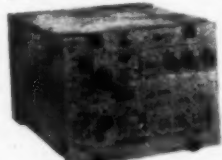
\$1.49

MINE DETECTOR

SCR 623 used.....
Brand new.....

\$49.95

Ass't mica condensers, Cat. No. C-12—per 100..... \$ 1.95
Wafer Sockets, 4-5-6-7 and 8 prong. Cat. No. WF-4—Per 100..... \$ 2.95
12" Utah P. M. Speaker, Ahico No. 5 with 6F6 output transformer. Cat. No. ST-100 \$ 6.95
Ass't knobs push on wood and plastic. Cat. No. KP-100—per 100..... \$ 1.95
Johnson sockets No. 210-23W. Cat. No. JS-210..... 49c
Sockets for acorn tubes. Cat. No. AT-10... 19c
Jacks PL 55, PL 68..... 15c
Powdered iron slug with Isolantite coil form to match, ideal for broad tuning. E. C. O. 25c
Powdered 3/8 slug..... 10c
1 Meg. Shalcrafts Acra—Ohm wire wound resistors ± 1W..... 89c



Transmitter & Receiver

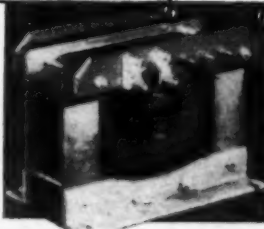
The famous boat anchor, widely used on the 144 MC band. Complete power supply 110V—AC. Less power transformer and tubes. Shipping weight 100 lbs.

\$14.95

MODULATION TRANSFORMER 1KW

\$14.95

Shipping weight 52 lbs.
RCA modulation transformer is conservatively rated at 550 Watt audio to modulate that new KW rig. Really rugged construction with protective flashover gaps, which are adjustable. Terminals and gaps are mounted on a "Mycalox" terminal board. The laminations that make up this transformer are of high audio quality and are extremely thin, making it impossible for the core to "chatter or talk".
Audio Watts—550 Sec. #1-450 Mils Sec. #2-80 Mils Turns
Ratio—Pri. Sec. #1-1:1 Pri. Sec. #2-5:1 Pri. Sec. #2 Tap-25:1
Impedance Ratio—Pri. #1-1:1 Sec. Pri. Sec. #2-25:1 Pri. Sec. #2 Tap-625:1
DC Resistance—Pri. 135 ohms Sec. #1, 112 ohms; Sec. #2, 95 ohms.
Transformers insulation tested: Pri. 8000V; Sec. #2-2000V. to the rest of the coils and core. Primary center tapped for Class "B" modulators. Secondary #2 will carry 80 Mils to modulate screens of beam power or screen grid tubes. Primary will match any Class "B" tubes up to 10,000 ohms plate to plate, such as 810's, 75T's, 8005's, 2B120's, 203's, HY512's, 211's, 813's, 828's, 805's, 2037's.
Size 9 1/2" wide, 7 1/2" deep, 7 1/4" high. Heavy channel iron mounting brackets. Weight approx. 40 lbs.



BC 654 TRANSMITTER & RECEIVER

Frequencies range 3800-5800 KC.—calibration every 10 KC. —with crystal oscillator checked every 200 KC. Power output 17 watts, voice or CW. Complete with tubes and 200 KC. X-ial.

\$14.95

CHOKES

THORDARSON T48003

2H—7H 550 MA swing choke. Size 4 1/2 x 5 1/2 x 5 1/2. Square black crackle case. Cat. No. FC-205.....

\$5.95

Thordarson BHY 150M choke, Cat. No. FC201—95c
Thordarson BHY 175M choke, Cat. No. FC202—\$1.49
Thordarson 12HY 25M choke, Cat. No. FC203—39c
Thordarson BHY 350M choke, Cat. No. FC204—\$4.95

Receiver & Transmitter
SCR522, 100-156 MC. Used, in good condition. Complete with 18 tubes and crystals.....

\$29.95

BUTTERFLY Condensers

Oscillator butterfly assembly condenser 76 to 300 megacycles with acorn tube socket. Mounted on condenser. Catalog No. BC 3.....

\$1.95

Type B — frequency range 300 to 1000 megacycles to be used with 368 AS diodeknob tube. Cat No. BC2.....

95c



Sockets part of assembly

TUBES • TUBES • TUBES

813.....	\$ 5.45	IT4.....	354.....
RK60.....	1.25	IS5.....	IRS.....
VT127.....	2.95	3Q4.....	6SL7.....
VR150.....	.69	6SN7.....	6SA7.....
829.....	2.45	59c each	
872.....	1.95		
211.....	1.45		
654.....	1.50		
656.....	.95	955.....	.65
		9004.....	.65

BRAND NEW SCR-269-F AUTOMATIC DIRECTION FINDER RADIO COMPASS

COMPLETE WITH COMPONENT PARTS **\$75.00**

The radio compass SCR-269-F was designed to be the primary radio navigation compass for the United States Army and Navy Air Forces. Constant reception is possible day or night so that fixes can always be made to establish the plane's or ship's location. The azimuth indicator is divided into 360 degrees and is connected to the loop antenna, therefore making it possible to navigate the ship in any direction as preset on the dial. Plotting fixes is accomplished by selecting two or more stations and plotting these on the navigation map. The point of intersection of these lines indicates the location of the craft. This equipment comes complete with 17 tubes superheterodyne receiver which is tunable from 200-1750 KC in three bands. A complete instruction book for operation and maintenance accompanies this equipment.

- for—
- Commercial air lines
- Air charter planes
- Yachts
- Fishing vessels
- Home radios
- Ham operators
- Air freight planes

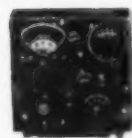
- 1 Radio Compass Receiver BC-433-F
- 1 Radio Control Box BC-434-F
- 1 Mounting FT-213-A
- 1 Mounting FT-224-F

- 1 Loop LP-21-F (Includes Dehydrator)
- 1 Cord CD-365-A
- 1 Indicator I-81-F
- 1 Relay SW-172
- 1 Plug PL-112
- 1 Plug PL-118

- 1 Plug PL-122
- 1 Dehydrator Hose, Fitting & Clamps 10 foot length
- 1 Operating & Maintenance Handbook
- 1 Coupling MC-136

- 1 Tuning Shaft MC-124 (300")
- 1 Insulator IN-79
- 1 Insulator IN-81
- 1 Shaft Casing and Spline Drive

- 1 Shafting F/MC-124 (300")
- 5 Nut F/MC-124
- 5 Spline F/MC-124
- 5 Sleeve F/MC-124
- 1 Transformer C289AS-R16-T



WRITE FOR

HRC

FREE BULLETIN

Herschel

RADIO COMPANY

5249 GRAND RIVER • DETROIT 8, MICH.

Mich. Sales Add 3% Sales Tax

Minimum Order \$2.00 F.O.B. Detroit

20% DEPOSIT REQUIRED ON ALL C.O.D. ORDERS

LOOK to WARD

Ward FM antennas stand head and shoulders above the field for value. Available in straight or folded dipole types (with or without reflector kit), they adapt easily to varying individual requirements. Providing the maximum electrical efficiency needed for finest FM reception, they are easy to install securely. Their trouble-free operation assures you extra profits. Write for free catalog today.

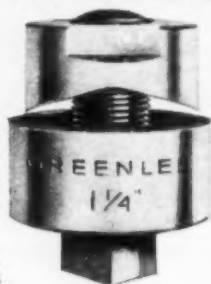
WARD

EXPORT DEPARTMENT: C. W. Brandes, Manager, 4900 Euclid Ave., Cleveland 3, Ohio
IN CANADA: Atlas Radio Corp., 560 King Street W., Toronto 1, Ontario, Canada

THE WARD PRODUCTS CORPORATION
1523 EAST 45th STREET, CLEVELAND 3, OHIO

Aerials

CUT HOLES $\frac{5}{8}$ " to $3\frac{1}{2}$ " IN RADIO CHASSIS

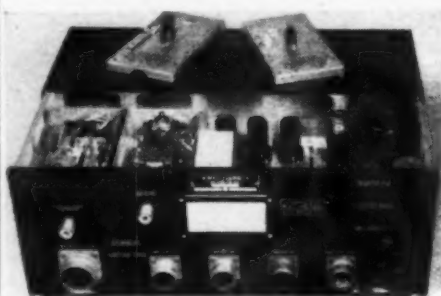


WITH A GREENLEE
RADIO CHASSIS PUNCH

• Save hours of work... no reaming or tedious filing. Punch cuts through chassis quickly... makes accurate, clean holes for sockets, plugs, and other receptacles. Just turn with an ordinary wrench. There's a GREENLEE Punch in each of these sizes: $\frac{5}{8}$ "; $\frac{3}{4}$ "; $\frac{1}{2}$ "; $1\frac{1}{4}$ "; $1\frac{3}{4}$ "; $1\frac{1}{2}$ "; $1\frac{3}{4}$ "; $1\frac{1}{2}$ "; $2\frac{1}{4}$ ". Write for complete facts. Also get information on Knockout Punches and Cutters for conduit and meter holes up to $3\frac{1}{2}$ ". Greenlee Tool Co., 1887 Columbia Avenue, Rockford, Illinois.

TOOLS FOR CRAFTSMEN

GREENLEE



ALTIMETER TRANSCEIVER RT-7/APN-1. Freq. 418-462 Mc; FM; with 14 tubes: 3-12SJ7, 4-12SH17, 2-12H6, 1-VR150, 2-955, 2-9004 and 27v 3a dynamtr. Possible uses: aerial mapping, burglar alarms, citizens' band. In case 8% "x7 1/2" x18 1/2". Wt. 25 lb. pld. W/book & diagram. As shown, NEW...\$13.95
TUBES immediate delivery.

New, indiv. cart. guarntd.	Ask for quantity disc.
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1J6G\$.80	6SC7\$.75
1LA6\$.45	6SR7GT\$.65
1T4\$.10	6SS7\$.70
3FP7\$.25	6T7G\$.75
5GP1\$.45	6U7G\$.60
5U4G\$.60	6V6GT\$.70
5Y4G\$.45	7A4\$.80
5Z4\$.80	7C7\$.80
6A8G\$.80	7E6\$.80
6C5GT/G\$.55	10Y\$.20
6D6\$.60	12CA\$.120
6F8G\$.85	12J5GT\$.60
6H6\$.55	12SF5GT\$.75
6K6GT\$.75	12SF7GT\$.70
6B8\$.65	25Z5\$.70
6K7G\$.60	37\$.45
6K8G & GT\$.90	39/44\$.65
6L7\$.95	45\$.40
6S7G\$.100	56\$.35
	9003\$.65

Transformers—115v 60 cy. *Indicates herm. sealed.
*250vDC 150ma, 5v 3a, 6.3v 5a Jeff. 1138...\$3.78
*315vDC 85ma, 5v 3a, 6.3v 2.1a Jeff. 1159...2.65
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CHOKES: 3.75 h 450ma 50 ~ General 344-5...3.95
12 h 200ma 105 ~ Thord T15C45 equivalent. 3.35
DYNAMOTOR & filter 1/SCR-522, 24v, used, good...1.95
Postage extra. Minimum order \$2.00. FREE LIST
Terms: Net cash. 25% deposit on C.O.D.'s

ELECTRONIC SUPPLIES

317 E. 2nd St.

Tulsa 3, Okla.

mc. Substituting in the formulas we find that the over-all length should be 116.9 inches. The dipole element should be 56.9 inches long with a spacing of approximately $1\frac{1}{2}$ inches between elements. Refer to Fig. 3 for further details. The folded dipole antenna multiplies the impedance of a half wave dipole by four and provides, practically speaking, a perfect match to the Amphenol 300 ohm twin lead transmission line. For best results with a minimum of noise interference, point the antenna broadside to the direction to be received from and mount it as high and as clear of objects as possible.

-30-

Modern Lighting

(Continued from page 45)

The two walls of the room and the ceiling on which the color is played should be finished white to permit the greatest range of effects. The entrance wall and the wall behind the listener should be a neutral gray reflecting about 60%. The floor should reflect about 30% as in the case of the main floor, but it should be a neutral gray also rather than a definite color. All color sensation in the booth should come from the play of the colored light on the wall and ceiling surfaces facing the listener.

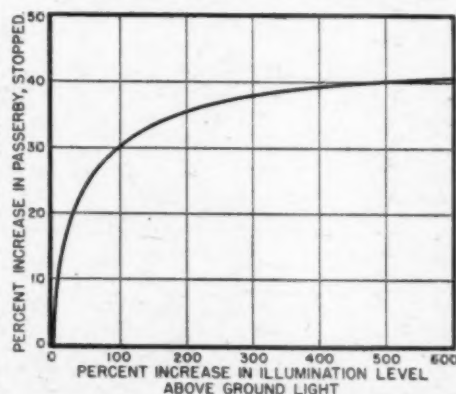
Fluorescent lights cannot be used for this purpose as they cannot be dimmed.

When Indirect Light May Be Used

Radio-appliance stores occasionally occupy the street-level floor of some large building. Such locations usually have a ceiling height of 14 to 16 feet. The merchant naturally takes advantage of this to use the entire floor for merchandising by putting his office on a mezzanine. In that case it is necessary to repeat the lighting troughs shown on the main ceiling, under the mezzanine.

Where no mezzanine exists the ceiling troughs can be eliminated from the front part of the store, if island displays with canopies are used, because the display canopies can serve as the location and platform for in-

Fig. 3. Stopping traffic is a definite function of lighting. This graph shows the increase in the number of customers who stopped to view display as lighting intensity on display was raised above ground light.



RADIO NEWS

DISPOSAL SALE OF SURPLUS VACUUM CAPACITORS

★ Offenbach & Reimus have been appointed sole agency for disposal of a large stock of war surplus vacuum capacitors made by—

ORDER DIRECT FROM
OFFENBACH & REIMUS CO.

373 ELLIS ST., SAN FRANCISCO 2, CAL.

THIS SALE WILL NOT BE REPEATED.

Jennings —RADIO—

VACUUM ELECTRONIC COMPONENTS

ADVANTAGES:

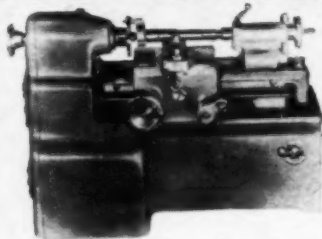
1. Relatively small physical size.
2. Electrical characteristics independent of atmospheric pressure and humidity.
3. No dielectric losses.
4. No ceramic or internal insulator.
5. Ferrule type mounting.
6. Zero power factor at most frequencies.
7. Low distributed capacity.
8. High current carrying capacity.
9. High voltage.
10. Unlimited life expectancy.
11. Universal adaptability.
12. Rugged mechanical construction.
13. Comparatively light weight.
14. No cold emission.



ALL BRAND NEW. In Original Factory Cartons. 100% Guarantee.

Type	Capacity	Peak Voltage	Reg. Price	Our Price
VC-6	6mmf	17,000	\$ 9.65	\$ 2.80
VC-12	12mmf	17,000	11.80	3.50
VC-50	50mmf	17,000	16.09	4.50
VC-100	100mmf	10,000	25.74	7.65
VC-150	150mmf	10,000	39.83	11.60
VC-200	200mmf	10,000	48.46	14.60
VC-250	250mmf	10,000	57.92	17.30

Jennings Capacitors Advertised Here Are Sold Only by Offenbach & Reimus Co. 372 Ellis St., San Francisco 2, California
THESE CONDENSERS ARE PRICED LOWER THAN MICA CAPACITORS!!



SMALL PRECISION LATHE WITH BUILT-IN MOTOR

A NEW POST-WAR PRODUCT—NOT SURPLUS
Distributed Nationally by Offenbach & Reimus Co.

★ The Machine Lathe is designed for small, precision work, and is an ideal machine where accuracy is essential for making of small parts and tools, for home workshop, laboratory, model builder and jeweler.

The Lathe is constructed of steel, cast iron and aluminum alloy parts; with gears of steel and brass. The cast iron bed has two large V ways, an expensive construction, to align headstock, carriage and tailstock, and is heavily reinforced with large cross braces.

The headstock is equipped with a hollow steel spindle mounted on self-aligning porous bronze bearings, these bearings being designed to take both radial and thrust loads. The spindle has a 3/16" hole through which bar stock up to 1/4" in diameter can be fed.

The machine is driven by a 110-volt alternating current induction motor, and controlled by a switch mounted on front of lathe base. The motor is mounted inside the base, and is protected by a fan.

The motor drive is by means of oil-proof Neoprene belts with necessary adjustment for keeping belt under proper tension at all times. A two-step pulley provides for two spindle speed changes.

The carriage is provided with hand wheel control as well as automatic power feed. A cam with locking set screw is located in front of apron, which with adjustable stainless steel plate at rear of carriage, will provide for any desired adjustment to take up for wear after long use. The carriage can be locked by means of screw located at right front top corner.

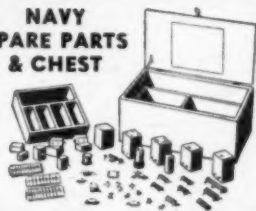
The quick clamping tailstock is operated by lever and adjustable cam, and eliminates the need of ordinary clamp bolt and wrench, and is designed for self-ejecting center.

The electrical equipment conforms to requirements of National Board of Fire Underwriters.

Regular equipment consists of 1 1/4" face plate, 2 lathe centers, tool post and rocker, Allen wrench, quick-clamping tailstock, 110V alternating current induction motor and switch, attachment plug with 6' cord. OVERALL DIMENSIONS: Length—9 3/16", Width—3 11/16", Height—6 3/4". WORK CAPACITY: Between Centers—3". Swing over Carriage—1 1/4". Swing over Bed—2". Collet Capacity—1/4". Shipping Weight—12 lbs. LIST \$58.50

Immediate Delivery. Price Includes Motor. Fully Guaranteed. Dealers—Write for Quantity Discounts.

NAVY SPARE PARTS & CHEST



• Beautiful plywood chest with metal handles and hasp. Finished in satin gray. 16"x7"x9", with removable tray. With parts, as follows: 5 wire-wound 5-watt resistors, 3 wire-wound 20-watt resistors, 26 carbon 1/2-w resistors, 7 mica condensers, 5 oil condensers, volume controls, audio choke, mike trans., output trans., and a dozen other fine parts. Everything brand new. In sealed cartons. At least \$25.00 worth of new parts at a sensational price.

20 Pounds. ONLY \$4.95 NET

Finest Components. Brand New.

• Beautiful plywood chest with metal handles and hasp. Finished in satin gray. 16"x7"x9", with removable tray. With parts, as follows: 5 wire-wound 5-watt resistors, 3 wire-wound 20-watt resistors, 26 carbon 1/2-w resistors, 7 mica condensers, 5 oil condensers, volume controls, audio choke, mike trans., output trans., and a dozen other fine parts. Everything brand new. In sealed cartons. At least \$25.00 worth of new parts at a sensational price.

\$5.00 GRAB-BAG SPECIAL!!!

• A 25-pound box of brand new parts, including a wide assortment of Amphenol connectors, relays, trimmer condensers, rotary switches, spaghetti, silver-plated dials, pilot lights, paper tubular condensers, finest Allen-Bradley 1-watt resistors, instrument mounting plate with shock mounts, generator condensers and an assortment of "surprises"—every one worth money. In addition, you get a STEEL tool box, Navy Type with handles and base—overall size 12"x18"x9". Never Has Such A Bargain Been Made. LIMITED STOCK!!



Sound-Powered Telephones

• Ultra sensitive dynamic units. Use one as mike, other as receiver, parallel connected. Talk up to 1 mile without batteries or transformer. Fine for intercom monitoring, marine, and industrial use. ONLY \$4.95.

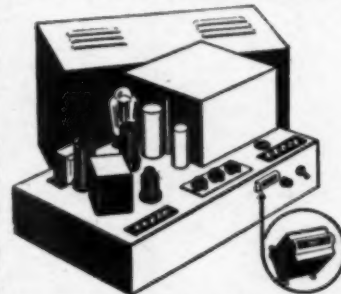
SIGMA SENSITIVE RELAYS (NEW)

2000 ohms. Ideal for Industrial Service. Limited Stock. \$2.49 ea. net; 10 for.....\$22.00

12-VOLT MINIATURE RELAYS (NEW)

Special low-loss insulation, 3-Pole. Single Throw. Bracket Mtg. Made by Allied Control Co. Only 69¢ ea., or 12 for.....\$6.00

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All-Purpose High-Power Amplifier

Licensed by
Western Electric
for Use in
P. A. Systems
and Phonographs

These brand new Amplifiers in factory-sealed cartons are a Manufacturer's over-run. JUST COMPLETED! Parts alone cost more than full price of the amplifier. Standard RCA tubes (2-6L6, 1-6SL7, 1-6C5, 1-6AU6), input for crystal or magnetic pickup, 600-ohm telephone line, and microphone. Separate Bass and Treble controls. Volume control. Output for standard 8-ohm speakers. Relay-operated COUNT-ER (10,000 counts) for coin-machine plays. Heavy-duty power supply. Gray crackled case with lid. 10"x17"x9". A big, husky job, 15 watts output, 110-120 v. 60 cycle AC operation. Complete with all tubes and wiring diagrams. This is one of the greatest bargains ever offered. You'll have to act FAST!

LIMITED QUANTITY. FIRST COME—FIRST SERVED.
ORDER TODAY!

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Power Supply for BC-348. Everything needed, including Stancor 90-ma Plate & Fil. Transformer, Filter Condensers, Choke, etc. ONLY \$6.50 net, including tube.

STANCOR TRANSFORMERS AT LOWEST PRICES NEW (NOT SURPLUS)

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(The type P6011 is ideal for BC-348 sets.)

CORNELL-DUBILIER CONDENSER BARGAIN

1/10-mfd. Tubulars, 600 w. NOT SURPLUS. Standard Carton of 50.....\$6.76 net

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BOX of 50.....Only \$6.25 net

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Base. Army surplus. Finest made. 4 for \$1.00

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1 1/2 to 55 Mh. Bendix-Schmitt 0-200.
0-100M ohms 9.95

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Illinois Cond.—.05 MFD, 600 V.D.C. 3 for
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Signal Corps Laboratory Receiver BC-180
built by ALLEN DUMONT LAB. Dry bat-
tery operated with Weston dual range
voltmeter to check, plug-in coils cover-
ing 2400-3700 KC included complete
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300 VCT 25 MA, 6.3 V-3.25 A, 5V 2A. \$1.49
Hammarlund 117V 60 cy PRI. Sec. 1
465VCT at 160 MA with ext. tap 300 V
at 11 MA, 6.3V at 7A, 5V at 3A, 5V
at 2A. 4.49
Signal Generator Power Transformer 117V
60 cy PRI. Sec. 295V at 80 MA 6.8V at
3.2A and 4.8V at 1.9 MA 3.2A. .99

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No. 2704P—10 henrys, 200 MA Cased. \$2.49
No. 2705P—20 henrys, 80 MA Cased. 1.49

POTENTIOMETERS
General Electric—600 ohm 4 watt
W.W. 1" shaft. 29c 4 for 99c
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watt W.W. 3" shaft. 29c 4 for 99c
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shaft. 29c 4 for 99c
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Western Electric—10,000 ohm 4
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C.T.S.—25,000 ohm Carbon Spdt
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Allen Bradley—1 Meg. Spdt Switch
1 1/2" shaft. 39c 3 for 99c
Potentiometer Kit—2 each of above. 22 for \$3.99

GOLD BAND 5% RESISTORS 1/2 & 1 WATT
1,000 ohms, 1,250 ohms, 1,500 ohms, 1,750 ohms, 2,000 ohms, 2,250 ohms, 2,500 ohms, 2,750 ohms, 3,000 ohms, 3,250 ohms, 3,500 ohms, 3,750 ohms, 4,000 ohms, 4,250 ohms, 4,500 ohms, 4,750 ohms, 5,000 ohms, 5,250 ohms, 5,500 ohms, 5,750 ohms, 6,000 ohms, 6,250 ohms, 6,500 ohms, 6,750 ohms, 7,000 ohms, 7,250 ohms, 7,500 ohms, 7,750 ohms, 8,000 ohms, 8,250 ohms, 8,500 ohms, 8,750 ohms, 9,000 ohms, 9,250 ohms, 9,500 ohms, 9,750 ohms, 10,000 ohms. 2c each 25 for 99c

Resistor Kit—1/2-1-2 Watt Excellent
Sizes 100 for \$1.95
Power Rheostats—25 and 50 watt six differ-
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AMMETERS
Weston Type—205P 0-60 Amps DC Ext.
Shunt Incl. 2 1/2" dia. \$2.95
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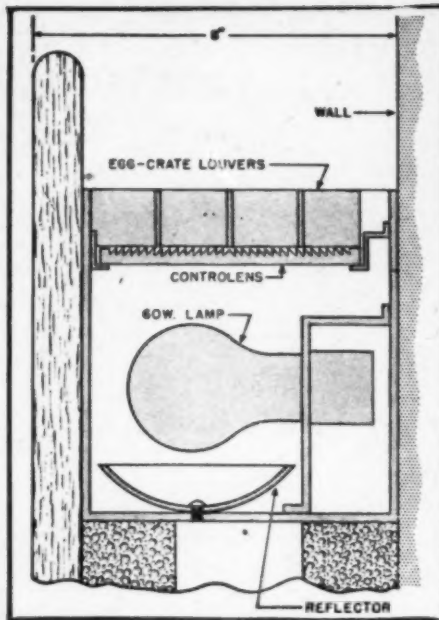


Fig. 4. Construction details for a "mood lighting" installation in a record booth.

candescant indirect lights as well as for the local lights that illuminate the articles on the island displays. The front portion of the store can then be lighted indirectly as the only merchandise on display would be in the self-lighted display islands. The ceiling troughs should still be used over the area devoted to counter sales.

When indirect lighting is resorted to, it should only be over a non-merchandising area and it should be remembered that it quickly grows dim from dirt and the deterioration of ceiling and wall finishes. It is excellent where critical seeing and action is not required, but it needs more maintenance than it usually gets to keep it from degenerating into a costly disappointment.

Show Windows

Fluorescent lamps are not recommended for radio-appliance window displays as their diffusion makes the top of the window brightest "where the merchandise isn't." They "wash" the display into the background by their contrast reducing effect, inducing a monotony and flatness that lacks appeal. Finally their color effect is chilling and unfamiliar, which is not suited to a display of merchandise that relies on emotional satisfaction for its appeal.

All standard makes of incandescent show window reflectors are of the "controlled direct lighting" type. All manufacturers provide complete installation details, and as the physical dimensions of the various kinds of units available are much the same the merchant finds the principal thing he has to determine is the size of lamp he should use.

This depends upon the number of footcandles needed to ensure the maximum sales return from the windows. Competition from neighboring windows is usually the governing factor.

WAR SURPLUS

TUBES

6V6—Metals \$.89
5Y3 GT45
No. 8045
Resistor Kit—1/2 & 1 W 100
assorted 2.00
Condenser Kit—.01—.00001
100 3.00
Choke—12H—DC Res 150
Ohms—80 MADC 1.09

OIL-FILLED CONDENSERS —G.E., C.D., ETC.			TRANSMITTING MICA CONDENSERS		
.05	1000 V	\$.30	.00005	1200 V	\$.33
.1	2500 V	.95	.00005	2500 V	.60
.1	7500 V	3.25	.00005	5000 V	.85
.12	15000 V	6.95	.00007	5000 V	.85
.25	4000 V	2.75	.0001	5000 V	.85
.25	6000 V	4.00	.0001	2500 V	.65
.5	1000 V	.35	.00025	2500 V	.85
.5	2000 V	.40	.00025	5000 V	1.10
.1	500 V	.25	.0005	2500 V	.65
.1	600 V	.30	.00072	5000 V	1.10
.1	440 V AC	.30	.0008	5000 V	1.10
.2	1000 V	.75	.001	5000 V	1.10
.2	600 V	.35	.00125	2000 V	.80
.2	330 V	.35	.0015	5000 V	1.10
.2	1000 V	.90	.0015	5000 V	1.10
.2	4000 V	4.45	.002	2500 V	.39
.6	2000 V	3.95	.005	2500 V	.39
.8	1000 V	1.75	.008	1200 V	.33
.10	600 V	1.20	.01	1500 V	1.45
3 x 2	4000 V	3.95	KIT of 12		3.98
3 x 10	90 V AC	.80		600 V	.65
10 x 25	600 V	.20		1000 V	1.00
.75	2000 V	.55		1500 V	1.45
3 x 22	300 V	.20			

\$2.00 min. order F.O.B. N. Y. C. Add postage
50% deposit, balance C.O.D. with all orders
Manufacturers inquiries invited.

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Torsional MAGNETOSTRICTION Pickup



- Response—50-10,000 c., ±3 db. With Pre-amplifier.
- Output—5 millivolts.
- Low mechanical impedance.
- Immune to severe shock.
- Impervious to high humidity, temperature.
- Osmium-tipped stylus.
- Impedance—400 ohms.
- Needle pressure—12-20 grams.

\$10.00 SEND CHECK OR MONEY ORDER

**MAGNETOSTRICTION DEVICES
SALES COMPANY**

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PEN-OSCIL-LITE

Extremely convenient test oscillator for all radio servicing: alignment • Small as a pen • Self powered • Range from 700 cycles audio to over 600 megacycles u.h.f. • Output from zero to 125 v. • Low in cost • Used by Signal Corps • Write for information.

**GENERAL TEST EQUIPMENT
38 Argyle Buffalo 9, N. Y.**

A conservative rule is to double the lighting level of competitive windows where that is possible. Where it is not possible then equality with such windows should be sought.

Where a motor trade is an important source of business and neighboring competition is negligible the illumination must be sufficient to permit the window to tell its story in six seconds—the maximum time it will be within view of the passengers of a car when the approach and retreat views are unobstructed. This requires a minimum of 100 footcandles which can be secured with 150 watt lamps on 12 inch centers. These lamps should be placed across the entire length of the show window. They should be as close to the window as possible and directed so that the light beam is focused back towards the merchandise.

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What's New in Radio

(Continued from page 76)

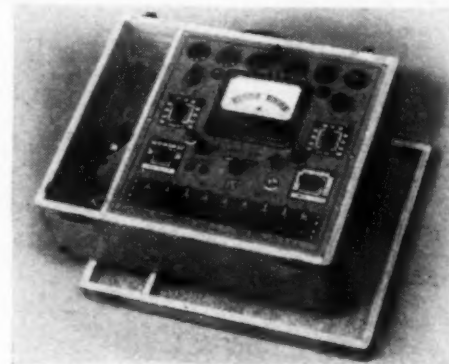
special skill or experience is necessary to use this kit, which contains a blower gun, brown flock, ivory flock, thinner, brush and instructions, and undercoat.

General Cement Manufacturing Company, 919 Taylor Avenue, Rockford, Illinois will furnish full details upon request.

TUBE TESTER

Electronic Measurements Corp. of New York is introducing their new Model 200 Mutual Conductance Tube Tester which checks mutual conductance on a calibrated micromho scale as well as on a "Reject-Good" scale.

The new test unit checks 5-element tubes as pentodes, checks tubes for gas content, provides sufficient plate cur-



rent to check both emission and mutual conductance and detects both shorted and open elements. Complete switching flexibility has been incorporated to allow the testing of all present and future tubes. Individual sections of multi-purpose tubes may also be checked on this unit.

Electronic Measurements Corp., 114 Liberty Street, New York 6, New York will send a full description of this unit and prices upon request.

HIGH VOLTAGE RESISTORS

A new line of resistors suitable for high voltage applications in television and other circuits has been announced

**DEALERS! ASSEMBLERS!
AMATEURS! SERVICEMEN!**

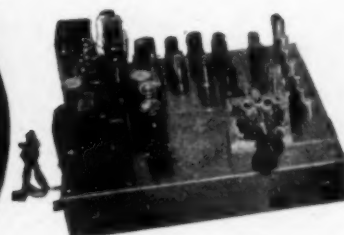
TELEVISION ASSEMBLY CO. Presents— THE FIRST 10" FLAT SURFACE SCREEN PICTURE IN ASSEMBLY FORM

No Eye Strain

BRIGHT

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Complete with 30 tubes, 12" speaker, and specially designed di-pole antenna with 60-ft. lead-in. A 13-channel tuner with FM sound. Only nationally advertised components used in our assembly.

The logical receiver for commercial installations such as Bowling Alleys, Cocktail Bars, Restaurants. Also the ideal unit for the home.

Large clear 10" flat surface picture using a direct view tube. This unit does not require a darkened or semi-darkened area. It will give you a clear bright view even in a lighted area. Easily assembled with soldering iron, screw driver, in very little time.

All major parts wired.

TERMS: 10% deposit with order,
Balance C.O.D.

I.F. Strip—This unit has been designed and constructed by the engineering staff of a well known manufacturer licensed by Western Electric and Radio Corporation of America. We guarantee this unit to compare in performance with any nationally known manufacturers making a similar size screen retailing at approx. list \$600, less installation.

\$229⁵⁰

COMPLETE WITH TUBES

FEATURES

- Picture I.F. Stages wired and pretuned.
- Sound I.F. Stages including Discriminator wired and pretuned.
- Video stages wired.
- The above features are all contained on one chassis mounted with several screws and connected with several wires. The unit contains 13 tubes.
- Complete front end consisting of R.F. Amplifier, Oscillator and mixer wired and pretuned. The above feature is constructed on one chassis also mounted with several screws and connected by several wires. This unit contains 3 tubes.

The above units are wired and tested by our engineers for your convenience

GUARANTEED

to operate to your satisfaction
when simple directions are followed.

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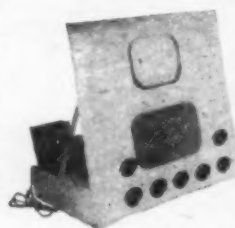
BROOKLYN 6, N. Y.

In New Jersey...
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TRANSMISION

TELEVISION KIT



Ready for easy rapid assembly. No knowledge of television required. Complete easy-to-follow instruction sheet gives you all the knowledge you need.

Reception is clear and sharp... comparable to a moving picture.

All necessary components are included. Nothing is required except a screw driver, cutting pliers and a soldering iron. Only the highest quality standard parts are used—the list price value of these parts alone is more than \$300. 110 volts, 60 cycles A.C. **\$159.50**

NEW!

Premier Model 570 MICROMASTER Band Spread Dial SIGNAL GENERATOR

For testing and aligning BROADCAST, SHORT-WAVE, FM and TELEVISION RECEIVERS. Exclusive Band Spread Dial geared to the tuning condenser and main dial, giving a total scale length of approximately 60 inches. Three-color dial directly calibrated in Kilocycles and Megacycles. Range: 75 KC—150 MC. Size: 12½" x 12" x 5½".



COMPLETE WITH TUBES \$54.75 AND CO-AXIAL CABLE. NET

GUARANTEED FILTER CONDENSERS

20x20x150 WV.

10 for **\$3.69**

3 Tube AC-DC PHONO AMPLIFIER KIT

Includes chassis, sockets, condensers, resistors, volume control with switch and diagram.

\$3.25

GUARANTEED VOLUME CONTROLS

Less Switch.....48c 10 for \$4.45
 With Switch.....59c 10 for \$5.45
 500,000, 100,000, 25,000 ohms; ¼ meg, 1 meg, 2 megs.

FEDERAL SELENIUM RECTIFIER

6 or more.....**.99 ea.**
 Less than 6.....**\$1.09 ea.**

Bargain! Guaranteed!

100 Assorted Bypass Condensers 600V

Value \$11.00.

\$6.95

SPECIAL

SUPERIOR Model 670

Super-Meter

A Combination Volt - Ohm Milliammeter plus Capacity Reactance Inductance and Decibel Measurements.

Complete with test leads and instructions.

\$28.40



Write Dept. N-7. 20% Deposit with order required. Please add sufficient postage. Excess will be refunded.

Variety ELECTRIC CO., Inc.
 601 Broad St., Newark 2, N. J.

by Resistance Products Company of Harrisburg, Pa.

Known as the Type B line, these units are available in several sizes to handle up to 35,000 volts at loads up to 10 watts. These resistors are made in values from .100 megohm to as high as 1,000,000 megohms.

The resistors can be easily mounted on a chassis by means of a machine screw although special high voltage mountings are available when required.

Typical applications include multipliers for v. t. v. m.'s, high resistance voltage dividers, bleeders in high voltage power circuits, television receivers, test equipment, x-ray circuits, etc.

Resistance Products Company, 714 Race Street, Harrisburg, Pa., will supply additional details upon request.

AMATEUR FREQUENCY METER

Browning Laboratories, Inc. has recently announced their new Model MJ-9 Amateur Frequency Meter which has been designed for checking the frequencies of FM or AM amateur transmitters operating in any band from 3.5 to 148 mc.

Bands covered include 3.5-4 mc., 7-7.3 mc., 14-14.4 mc., 20.5-21.5 mc., 28-29.7 mc., 50-54 mc., and 144-148 mc.



The meter is direct reading for all bands with separate coils for all bands except the 144-148 mc. range, this being covered by the harmonics of the 20.5-21.5 mc. band. A 500 kc. crystal controlled oscillator is used as a reference standard.

Over-all accuracy of the unit is .05% on all frequencies. The Model MJ-9 may be used in conjunction with a following class A amplifier as a substitute for the crystal oscillator in an amateur transmitter to provide variable frequency operation.

Full details and prices will be supplied by Browning Laboratories, Inc., Winchester, Massachusetts.

WIRE STRIPPER AND DISPLAY

General Cement Manufacturing Company of Rockford, Illinois is currently offering a complete merchandising package to jobbers.

A special customer demonstration display covering the company's "Speedex" wire strippers is being included without charge with the purchase of the strippers by jobbers. This metal rack is lithographed in a 3-color combination and includes a pocket for circulars.

General Cement Manufacturing Company of Rockford, Illinois will supply complete details on both the new "Speedex" wire stripper and the free demonstrator-display to those requesting information.

UNIVERSAL DIAL BELT

Of interest to radio servicemen is the new and unique universal dial belt which has been recently introduced by Walter L. Schott Co. of Beverly Hills.

This new "Walsco Unibelt" is manufactured in continuous lengths and put up on spools containing belting for an average of 5 to 8 dial belt replacements.

The simple construction of this new belt is made possible by using a patented, zipper-like connector that is inserted in each end of the belt. As the belt comes open it permits quick installation without taking the dial mechanism apart. Latex covering prevents any slipping and a thin flexible stainless steel core makes stretch impossible. This new unit permits the serviceman to replace a worn belt without carrying a complete assortment of belts.

Walter L. Schott Co., 9306 Santa Monica Boulevard, Beverly Hills, California will supply additional information on this unit and on their complete line of parts and equipment for the serviceman.

MINIATURE TUBE PULLER

A new tool which facilitates the easy removal of the new miniature type receiving tubes has been developed by The Oliveri Tool Co. of Chicago.

This small unit, known as the "AMO," incorporates a heat-resistant rubber cup, with aluminum body and a handy thumb-operated plunger release. Tubes may be either installed or removed without fear of breakage or burning the hands.

Prices and additional information on this miniature tube puller will be supplied on request to The Oliveri Tool Co., Dept. RN, 4000 West North Avenue, Chicago 39, Illinois.

MINIATURE TYPE 6AR5

Because of the low heater power and low plate current drain, the new Type 6AR5 miniature tube recently introduced by Hytron Radio & Electronics Corp. is especially suitable for use in low and medium priced automobile and home a.c. operated receivers.

The tube may be used in compact equipment where its low heat dissipation will prove particularly advantageous. Designed as the replacement for the type 6K6GT, this miniature pentode power amplifier provides 3.4 watts output with 250 volts on plate and screen under Class A₁ amplifier operation conditions.

Complete electrical specifications will be supplied by the Commercial Engineering Department, Hytron Radio & Electronics Corp., Salem, Massachusetts.

—50—

RADIO NEWS

Scoop!

NEW BC-728-A PORTABLE RECEIVER

Police-Shortwave-Marine-Telephone
75 Meter Ham Band—Fire Department



Perfect Receiver for Field Day Use or for Emergency Receiving Equipment. Pick it up and carry it anywhere. Has one stage R.F., converter, one stage I.F., detector and A.V.C. Pushbutton channel selector, and two stages A.F. Uses all miniature low drain tubes. This Receiver is built to rigid Army specifications, and originally designed as emergency equipment to be carried in jeeps. It is rugged . . . dependable . . . durable . . . Limited quantity.

*Outstanding
Features*

- Seven-Tube Superhet
- Tunes from 2-6 mc
- Operates on Wet or Dry Cell Batteries
- Designed for 2-volt input from Self-Contained Wet Cell Battery which can be recharged from 6 v. Battery.
- Can be easily padded for Broadcast Band with 300MMFD Condensers.
- Portable
- Four Push Buttons
- 4" Speaker with Heavy Slug

2-Volt Storage Battery to fit Compact Space Available. **\$3.49**

PRICED at
Complete with Tubes, Power Supply
(less battery) and battery charger

\$12⁹⁵

20% Deposit on all orders unless rated. We prepay freight on \$100.00 orders in U.S.A.

NIAGARA RADIO SUPPLY CORP.

160 Greenwich St. New York City 6, N. Y.

Write for latest Bulletin 7 RN.
All prices F.O.B. New York City.



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TELEVISION & RADIO

Melville Radio Institute, a well-established, prewar school, is one of New York's outstanding vocational training centers.

Technical know-how, ample equipment and expert faculty have resulted in a satisfied student body that is among New York's largest.

Visit us today without obligation and watch the School in operation. A free brochure may be obtained by mailing the attached coupon.

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Every Radio Serviceman Needs This New **FREE** AC-DC BALLAST TUBE MANUAL

JFD's new 68-Page Ballast Manual is a treasury of information for Radio Servicemen and Dealers — **AND ITS' FREE!**

10,000,000 radios now in use employ plug-in ballasts. Eliminate guesswork when replacing — consult the JFD Ballast Manual. It lists:

1. More than 3000 radio ballasts.
2. AC-DC ballasts for fluorescent lights & electrical appliances.
3. Stepdown ballasts, 220 to 110 V.

Servicemen: YOUR FREE COPY of this book (value \$1.50) is now ready for you. To obtain it, merely mail in to JFD factory twelve flaps from JFD Radio Dial Belt envelopes; include 10c in postage to cover mailing cost. This book is also included in JFD Belt Kits B25A, B50A, B100A. (Buy your JFD belts and belt kits from your nearest parts jobber).

No radio service shop can afford to be without this complete and essential source of information on Ballast Tubes. Send for YOUR copy today!



J.F.D. MANUFACTURING CO.

4109-4123 FORT HAMILTON PARKWAY, BROOKLYN 19, N. Y.

U.S.N. MODEL 6 TUBE SHIP RECEIVER—MODEL RAK-5



YOUR PRICE
\$29.95

Complete
with tubes

The ideal commercial receiver for experimenters, hams, aviation, marine, etc.

Two tuned RF stages—band switching panel—DB meter, AVC level control antenna and RF controls—audio tuning control—sensitivity controls including an AC-DC filament voltmeter with range of 10 volts. Value \$350.00.

NAVY COMPARTMENT SPEAKER AMPLIFIER UNIT With Heavy Duty Speaker (32 oz.)



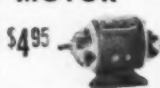
Works from 110 volts AC-DC. Used but in operating condition. Uses 1-35Z5 Rect. & 2-35L6 in P.P. Audio input .006 watts 600 ohms imp. 5 Channel selection input, volume control complete with tubes in gray navy case 14x14x7 1/2" for wall mounting.

YOUR PRICE
\$11.50

VALUE \$180.00

110 VOLT AC MOTOR

Heavy duty construction. Fractional H.P. ball bearing brand new. Ideal for power tools, fans and 100 other uses.



\$4.95

IN LOTS OF 10—\$4.50

All merchandise fully guaranteed

All prices F.O.B. New York City

25% deposit with order—balance express collect

Write for Quantity Prices on Other Items

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INDUSTRIES CORPORATION

74 Cortlandt St., NEW YORK 7, N. Y.

POTTER'S NEW DEAL ON CRYSTALS

80 Meter

3500 to 4000 KC.

In DC-11 Holders.....**74c Each**
In FT-243 Holders.....**79c Each**

40-20-10 Meter

7000 to 7425 KC. **79c Each**
FT-243 Holders

6 Meter

6250 to 6750 KC. **79c Each**
8335 to 9000 KC.
FT-243 Holders

2 1/2 Meter

8000 to 8222 KC. **79c Each**
FT-243 Holders

Above filled from stock within plus or minus 10KC. of your specified frequency. We will make any of the above crystals to plus or minus 2 KC on fundamental of your specified frequency, in either DC-11 or FT-243 Holder at **99c each**.

1812 to 1856 KC. for F.M.**\$1.49**
3105 KC. for civilian Aircraft..... **1.49**
12 Rough blanks (kit)..... **.79**
Crystal Finishing Kit..... **.79**
10 Asst. Crystal Holders..... **.99**

POSTAGE EXTRA. Write for our free BARGAIN list.

POTTER RADIO CO.

1312-14 McGee St. Kansas City 6, Mo.

International Short-Wave

(Continued from page 68)

American Consulate-General, Algiers, Algeria. *Radio Algerie*, 11.835, is evidently in Algiers, not Constantine; letter verie in *English* definitely verifies this frequency; duration was three months; report to *Radio Algerie*, Services Techniques de la Radiodiffusion, 10 Rue Hoche, Algiers, Algeria. WXFG, Adak, Alaska, which utilizes 16.025, 12.265, 8.860, should be addressed at Alaska Communications System, Officer-in-Charge, A.P.O. 980, % Postmaster, Seattle, Washington, U.S.A.; verifies within two weeks. All RCA point-to-point stations in Puerto Rico heard on frequency tests will verify from Radio Corporation of Puerto Rico, P. O. Box 3746, San Juan, Puerto Rico; usually use WKAQ parchment verie form. FGSAH is the official call for *Radio Guadeloupe*, though never used; the "AH" are initials of Mons. Andre Haan, head of the station; card is extremely attractive; required six months; QRA is *Radio Guadeloupe*, Box 125, Pointe-a-Pitre, Guadeloupe, French West Indies.

This Month's Schedules

Albania—ZAA, 7.852, *Radio Tirana*, still has news at 1515. (Pearce)

Algiers—Relaying programs from the United States, Algiers I, 9.610, is beamed to Western Europe, 1300-1745; Algiers III, 11.765, has same schedule but is directed to Balkans.

Andorra—*Radio Andorra*, 5.985, still has *English* program 1600-1630; asks for letters *direct* to the station. (Pearce)

Anglo-Egyptian Sudan—*Radio Omdurman*, 13.320, appears to have changed time of *English* transmission formerly at 1230 Thursday, as only Arabic is now heard then. (Pearce) Frequency of about 9.650 is supposed to parallel.

Angola—CR6RB, 9.165, Benguela, heard on West Coast with weak signal—in French—at 1345. (Nankervis) This station runs 1315-1400 sign-off. (Laubscher)

Argentina—LRR, 11.88, Buenos Aires, is heard in Australia at 0400; callsign and country announced often. (Sanderson)

Australia—For the summer, *Radio Australia* has set forward by one hour its morning beam to Eastern North America, now heard 0700-0815, with news at 0700 and 0800, on VLB, 9.54, and VLC7, 11.84; VLG10, 11.76, is scheduled to also carry this beam to 0800. The evening beam to the East Coast is currently using VLA5, 15.32 (badly QRM'd in many quarters) and VLC9, 17.84, 1830-1945, with news at 1900. To the West Coast, 1100-1200, VLA8, 11.76 and VLC6, 9.615, are used, while VLG4, 11.84, parallels to South Africa. The 2345-0045 beam to West Coast is carried by VLA5, 15.32, VLC9, 17.84, with VLB8, 21.60, and VLG6, 15.24, used daily except Friday, news at 0015.

RADIO NEWS

The beam to the British Isles and Europe is now heard over VLA8, 11.76, and VLC11, 15.21, 1245-1415; beamed there 1000-1045 are VLA6, 15.20, VLC9, 17.84, and VLG10, 11.76, while VLB4, 11.81, is used a full hour, that is, to 1100; also used 0115-0230 are VLA6, 15.20, and VLB8, 21.60, with VLC9, 17.84, used from 0145, but on Saturdays, only VLA6 and VLC9 are employed.

VLH5, 15.23, has fine signals from 0000 in domestic service. (Balbi)

Latest calls and frequencies listed are: VLA, Shepparton, 100 kw.—VLA, 7.28; VLA2, 9.615; VLA3, 9.68; VLA4, 11.77; VLA5, 15.32; VLA6, 15.20; VLA7, 17.80; VLA8, 11.76; VLA9, 21.60; VLA10, 17.84. VLB, Shepparton, 100 kw.—VLB, 9.54; VLB2, 9.68; VLB3, 11.77; VLB4, 11.81; VLB5, 21.54; VLB6, 15.20; VLB7, 17.80; VLB8, 21.60; VLB9, 9.615; VLB10, 11.74. VLC, Shepparton, 50 kw.—VLC2, 7.28; VLC9, 17.84; VLC10, 21.68; VLC11, 15.21. VLG, Lyndhurst, 10 kw.—VLG, 9.58; VLG3, 11.71; VLG4, 11.84; VLG5, 11.88; VLG6, 15.24; VLG7, 15.16; VLG9, 11.90; VLG10, 11.76.

Austria—Although reported off the air, KOFA, 7.220, Blue Danube Network of the AFRS, has been heard in Britain as late as in April, around 2355-0100; signs on at 0000, according to announcement. (Pearce) Heard in Belgium at 1615. (Salmon)

Radio Wien, 12.210, heard on West Coast signing off at 1800 after relaying portion of an AFRS program; not heard often on West Coast. (Nankervis) The 11.780 and 9.670 frequencies are heard in Britain late mornings, using metronome interval signal and call of "Radio Wien," but carry separate programs; the 7.150 frequency has been heard at 0050 in parallel with 9.670. (Pearce)

Azores—Ponta Delgada, 4.85, signs on daily at 1600. (Pearce) Fair signal in Massachusetts, 1730-1800, mostly music. (Hudson)

Barbados—VPO8, 19.055, Bridgetown, heard well around 0730-0745, contacting GAQ2, London. (NNRC)

Belgian Congo—Leopoldville's 17.770 frequency is being heard afternoons in New York with excellent level. (Bartholomew) This frequency is used in the transmission to British Isles and Europe, opening at 1530 with news. (Pearce) Has been heard as late as 1750 in Belgium. (Salmon)

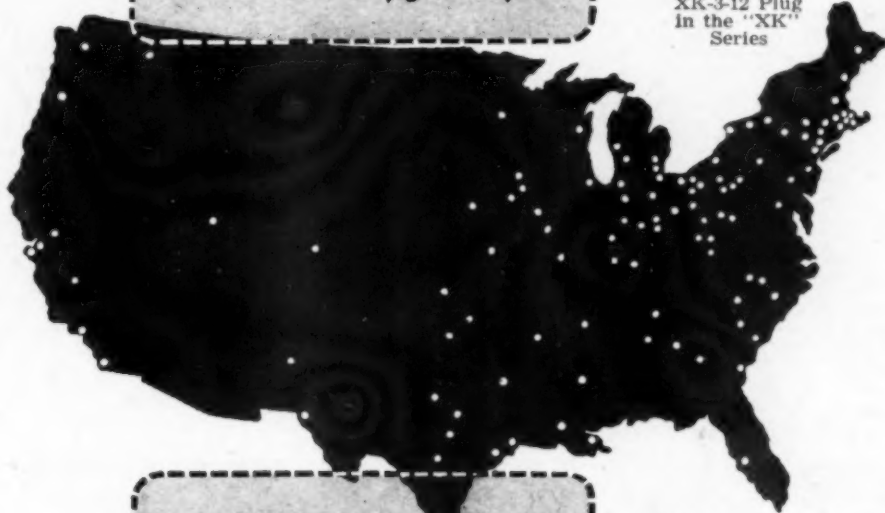
Belgium—Brussels, 21.450, heard daily 1045-1200. (NNRC)

Brazil—PRE-9, 15.165, Fortaleza, heard irregularly, usually 1930-2030; often carries opera. (Nankervis)

Britain—Current frequencies directed to North America are GSI, 15.260, 0500-0600; GRP, 18.130, 0500-1115; GRP, 18.130, 1130-1615; GSI, 15.260, 1615-2015 (to West Coast); GSP, 15.310, 1615-2145; GWH, 11.800, 1800-2300; GRH, 9.825, 1830-2300; and GWO, 9.625, 1915-2300 (to West Coast).

British Guiana—ZFY, 6.000, Georgetown, is being heard in Sweden around 1500-1930. (Ebbesson)

*Now you can
buy all these
CANNON
plugs receptacles
and accessory fittings*



*-in 6 type series
from more than
125* distributors*

To make it easier and quicker to obtain fittings in the above illustrated Cannon Electric Type Connector Series, more than 125* radio and electrical distributors can fill your requirements. Many of these distributors carry stock items on their shelves for immediate delivery. They are ready to serve you and discuss your requirements. Contact them first.

These type series are widely used on microphones, sound equipment, in radio and electronic devices. Their quality and performance are assured by Cannon Electric's thirty-two years of continuous operation under the same management.

For a complete list of Representatives, Distributors and a Catalog covering these lines, write for Bulletins CED and RJC-1, Address Dept. G-228.

XL-3-12 Plug
in the "XL"
Series



X-3-11 Plug
in the "X"
Series



XK-3-12 Plug
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Series

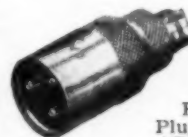
O3-11
Receptacle
in the "O"
Series



TQ-1-12 Plug
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Coaxial
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P3-CG-12
Plug in the
"P" Series



*Additional distributors
are being added
in certain states.



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IF AMPLIFIER FOR 36 MEGACYCLES



How long have you waited for a "super-duper" IF strip to come along? Here it is at last. 4 stages of double tuned hi-gain IF. Completely shielded (gain approx. 50,000). Bandwidth 1.4 mc \pm 0.4 mc. Uses 4-6AC7 IF tubes, 1-6SJ7 infinite imped. detect. and 2-9002 AVC tubes. Has external cable for connection to 6.3 volt fil. and 250 VDC plate supply. Co-ax jacks for input and output. Diagram and tech. info. supplied. Units mfg'd by GE and brand new! Dimen. 18% L x 5% W x 4% H. Ship. wt. 28 lbs.

YOUR COST WITH 7 TUBES.... **\$16.85**

IF COIL KIT FOR 36 MEGACYCLES

Construct a hi-gain 36 mc IF amp. & 2nd detector (5 stage) to your own physical specs. using these hi-grade iron tuned, ceramic form mounted IF Xformers. Identical to those used in the IF amp. pictured above. All Xformers unshielded, will provide a total gain approx. 50,000 when wired according to diagram supplied with each order. Kit comprises total of 11 RF chokes & Xformers.

YOUR COST WITH DIAGRAM.... **\$4.60**

DUAL TURBO BLOWER

These excellent blowers were mfd. by Delco Motors and designed to supply 200 cu. ft. of air per min. in continuous operation. Power consumption 85 watts at 115 volts 60 cycles. Beautifully balanced, quiet & vibration free operation with 100 cu. ft./min. available from each turbo. Ideal for cooling Xmitting tubes, power supply cabinets, room ventilation, etc. Complete with mtg. bracket & line cord.

YOUR COST—BRAND NEW!... **\$14.90**

FIELD PHONE EE-8-B

Grand—unusual buy! Standard Signal Corps field telephone with self-contained, hand cranked generator. Positive communication to two miles and over with any good twisted pair telephone wire. Contained in water proofed canvas carrying case with strap Brand new!

YOUR COST—EACH UNIT..... **\$32.50**

PER PAIR (2 units)..... **\$9.50**

POWER TRANSFORMERS

(All have 115 V 60 ~ primaries.)

Thordarson #92R21—390-0 390 V @ 200 MA.
5 V @ 3 amps, 6.3 V @ 5 amps.... **\$6.50**

Wheeler #K59J335—310-0 310 V @ 170 MA.
5 V @ 3 amps, 6.3 V @ 5 amps, hermetically sealed **\$4.50**

Dongan #A460—3200 VAC@15 MA. hermetically sealed, excellent television.... **\$5.25**

FILTER CHOKES

Thordarson #13C39—8 henries @ 150 MA. **\$1.20**

GE 12 henries @ 165 MA. hermetically sealed, 800 V insul. 107 ohms.... **\$1.70**

No orders under \$5.00. All merchandise new, unused and fully guaranteed. 20% deposit with order. Balance COD. All orders FOB New York.

KELVIN ELECTRONICS

74 Cortlandt St., New York 7, N. Y.

Bulgaria—Radio Sofia, 9.350, has news at 1530-1540 sign-off. (Zachrisson) Wants reports to Anglo-American Service, Radio Sofia, Sofia, Bulgaria. According to ISWC, London, is heard on 7.67, 1400-1740. Has announced now has verification cards.

Burma—Rangoon, 6.035, now is officially scheduled 0815-0915 for its English period; lists frequency of 6.040 and confirms that is no longer under military administration. (Dilg) Is no longer known as Rangoon Radio but as Burma Broadcasting Service, Rangoon, Burma, which is sufficient address for reports; engineer is named Kyeetin; transmitter is located 21 miles up Rangoon River which flows into Gulf of Martaban, according to verie received. (Riggle)

Canada—CBLX, 15.095, Montreal, now signs off at 2300; replaced CBFX. CKRX, 11.72, Winnipeg, Manitoba, has not been heard lately. (Balbi) CKRO, Winnipeg, is now off 6.150. (URDXC) CFRX, 6.070, Toronto, Ontario, lists schedule of 0600-0035. (Morck)

Ceylon—Official schedules for main program of Radio SEAC, Colombo, are 1930-1200, 6.075, 9.520, 3.395; 1930-2300, 2330-0500, 0700-1115, 15.120; 2300-0730, 1103-1200, 17.77; Indian Forces program, 2300-2330, 0500-0700, 15.120.

In order to conform to Britain's change to double summertime, the Sunday beam to the United Kingdom is at 1130-1330 on 15.120, 9.520, 6.075; possibly also using 41-meter band (about 7.180) in parallel, announces as beamed to Southeast Asia and India as well as to the United Kingdom. (Dilg) This new schedule is confirmed by Pearce, England, who reports that the 17.770 frequency is heard there now with weak signal around 1000; the 15.120 channel closes regular transmission now at 1115 on Sundays, but other days runs to 1200. (While the 9.520 frequency is listed and announced as used to parallel 15.120 throughout the broadcast day, 1930-1200 (except Sunday when ends at 1115), I have had no reports of reception of this frequency in either the Western Hemisphere or in Europe.)

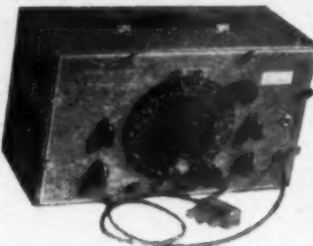
China—An airmail letter from Fung Chien, director of Chinese International Broadcasting Station, XGOY, confirms plans for development and expansion of international services: "We are now planning to install two 20-kw. short-wave stations and one 100-kw. medium-wave station in Nanking, and another 50-kw. medium-wave station in Shanghai. The 7.5-kw. short-wave station, XGOA, Nanking, is now transmitting a North American Service daily on 15.350, beginning at 2100." (Advice from Nanking indicates the use of both 15.350 and 9.730 for this daily beam, mostly in English, 2100-2300; however, we have received no reports of reception in North America of either frequency at the time so scheduled.)

Official summer schedules for The Central Broadcasting Administration Network in China, as given by Director Fung Chien, are: XGOA, Nan-

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king, 9.730, 2 kw., 2200-2330; 5.918, 7.5 kw., 0300-1000; 11.835, 7.5 kw., schedule not listed. XORA, Shanghai, 11.690, 5 kw., 1745-2000, 0200-0900. XRRA, Peiping, 6.090, 10 kw., 1830-1930, 0500-0815 (*I believe is now on summer frequency of about 10.260*). XUPA, Banchiao (Taiwan), 9.680, 3 kw., 0300-0855. XTPA, Canton, 11.650, 1 kw., 2200-0030, 0400-0830. XLRA, Hankow, 6.054, 1 kw., 2230-2330; 12.500, 1 kw., 0430-0845. XGOY, 15.200, 35 kw., 0355-1050; frequencies of 11.913, 9.635, and 6.140, are listed with 35 kw., and 7.153 is listed with 10 kw., but no schedules were given. XPRA, Kunming, 6.404, 1.5 kw., 0530-1000. XPSA, Kweiyang (Kweichow), 7.007, 10 kw., 1755-1830; XMRA, Lanchow (Kansu), 9.750, 1 kw., 2330-0100, 0500-0830. (*Readers are reminded that Chinese stations make almost constant changes in frequencies used and in schedules; hence, much monitoring is required to keep abreast of them.*)

XGOY official schedules, just in, list: To Australia, New Zealand, and East Asia (*no English mentioned*), 11.913, 0355-0530; to East Asia and South Seas, 9.658 and 7.153, 0535-0735, news at 0600 and 0630, and with Chinese music at 0635 on Tuesdays, Thursdays; to North America, 9.658 and 7.153, 0740-0945, news at 0800, news at dictation speed at 0900 on weekdays, and with special program, "Bringing Christ to the Nations," at 0830 on Sundays; to Europe, South Seas and China proper, 11.913 and 7.153, 0955-1050, news at 1000.

In XGOY's first transmission on 11.913, news is no longer read at 0500. (Balbi)

XMAG has been heard irregularly mornings on about 11.29. Although Hong Kong summertime is 14 hours ahead of EST, the news relay from the BBC is still heard at 0600 on 9.515. XGOUS, about 9.123, Nanking, used chiefly for press dispatches to the United States, is now on summertime, opens around 0800. XRRA, Peiping, appears to be on its summer frequency of 10.260, good signals mornings, but bothered by heavy CWQRM; should carry XGOY's news at 0800; has been heard as late as 0850, but exact schedule is not known. (Dilg)

XLRA, approximately 10.22, Hankow, is heard on this frequency irregularly, as late as 0945. (Balbi)

In a verie received, XORA, Shanghai, stated that *English* programs are radiated at 0400-0515, 0615-0640; frequency is 11.690. (Kary)

XNG5, 19.450, Shanghai, is the new transmitter for U. S. service, just gone into operation; reported with superpower; should be heard around 1900. (NNRC)

XGOA, 15.350, Nanking, reported with musical program around 2330-0030; has woman announcer. (NNRC)

XNCR, 7.52, Yenai, is heard in Australia at 0530 with news in Chinese. (Sanderson)

Costa Rica—TIGPH, "Alma Tica," is heard irregularly to sign-off at 2300 on 5.875. (Beck)

Curacao—PJC-1, 7.250, Willemstad,

heard in Massachusetts signing off at 2130. (Harris)

Czechoslovakia—In order to accommodate those on summertime, Prague has put forward its programs by one hour for the summer. OLR5A, 15.23, is now directed to North America *daily*, 1800-1900; programs come from Prague and Bratislava, of 40 and 20 minutes, respectively. Programs are varied but always include ten-minute review of news in Czech and Slovak, and about ten minutes of news in *English* (around 1835). (Information from the station indicates that the severe damage done during bombardment in the late war has not been entirely repaired to date.) Programs are recorded each evening on bands of artificial material, which has magnetic ferrous oxide in it; it is electromagnetized. The transmitter is a high-frequency Magnetophone; equipment is of German manufacture; receiving equipment includes two Minervas, one Telefunken, German makes, one Dutch Philips, and two British Marconis. The Czechoslovak Broadcasting Corporation has in preparation a pamphlet about the station.

News is now heard at 1245 over OLR3A, 9.55; at 1445 and 1645 over OLR2A, 6.010. (Laubscher) OLR2A, 6.010, has new *English* period, 0945-1000. (Harrison) Prague is now verifying with a nice card showing a view of the capital on one side, with verification details on reverse. (Gillett)

Denmark—Radio Danmark, Copenhagen
(Continued on page 142)

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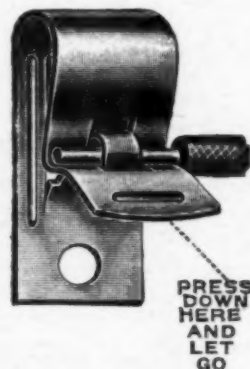
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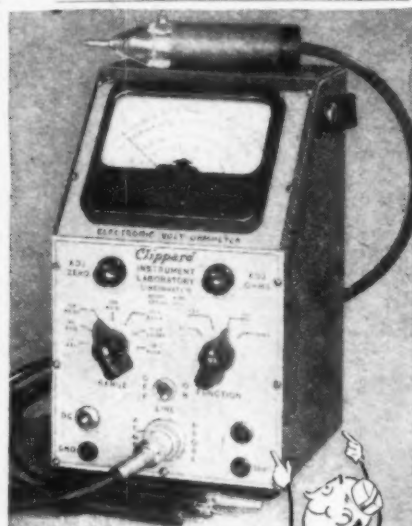


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Sound Recording (Continued from page 57)

the electric effects along this axis are by far the most pronounced. The two fundamental "a-cut" plates used are the expander and shear plate shown in (C) and (D) of Fig. 3. It will be noted that the expander plate is cut at a forty-five degree angle to the *b* and *c* axes and the shear plate is cut with edges parallel to the *b* and *c* axes.

When a voltage of given polarity is applied to the two faces of each plate, the mechanical motions developed will be at forty-five degrees to the *b* and *c* axes. This means that the expander plate shown in (C) of Fig. 3 will increase its length and simultaneously decrease its width. These two actions reverse on change of polarity of the applied voltage. The cut of the shear plate (D) of Fig. 3 shows that a similar action occurs but that expansions and contractions occur approximately along the diagonals of the plate instead of in directions parallel to the edges, as in the case of the expander plate.

Two or more crystal plates properly oriented with respect to each other are cemented together to provide more efficient utilization of the piezoelectric properties of the crystal. Two or more expander plates when cemented together form a *bender* element and two or more shear plates when cemented together form a *twister* element. These names "bender" and "twister" have been selected since they indicate the resulting motion of the final element when an electrical potential is applied.

Both bender and twister elements, because of their multiple plate construction, are further classified as "Bimorphs." This type of construction has the advantage over the single plate crystal of practically eliminating the generally undesirable effects of saturation and hysteresis and of greatly reducing the effects of temperature on sensitivity and impedance. Construction of the bender and twister "Bimorph" elements are shown in Fig. 4A. Prior to the final assembly, the two faces of each crystal plate are milled smooth and graphite or foil electrodes are applied. Metal leads are connected to the electrodes and the plates, after proper orientation, are bonded together with a cement. The electrodes are connected either in parallel or in series, depending on the application for which the final element is constructed. The parallel lead arrangement, however, is standard and is shown in Fig. 4B. The assembled crystal element is finally coated with a specially prepared moisture-proofing material for protection against deterioration in unusually dry or damp conditions of use.

Rochelle salt crystals operate safely from -40 to +130 degrees Fahrenheit. They have their greatest piezoelectric activity at normal room tem-

perature, 72 degrees Fahrenheit. Upon exposure to temperatures higher than 130 degrees Fahrenheit, the crystals lose their piezoelectric properties permanently. The voltage developed by the crystal elements for a given stress remains constant over the temperature range provided that the load impedance for all conditions is much higher than the crystal impedance. This generated voltage is practically proportional to the applied stress. Conversely, the amplitude of motion produced when the crystal is used as a motor, is also practically proportional to the applied voltage.

In the design of circuits using crystal devices, the crystal element may be considered as a pure capacity.

Operation of a Crystal Cutter

A well designed crystal cutter is capable of producing excellent records. It has a wide and uniform frequency response and is practically free from harmonic distortion. Exceptionally efficient in operation, it permits the use of a driving amplifier of relatively low power output².

Because of the inherent stiffness of the crystal and stylus arrangement, the amplitude and frequency response are almost completely unaffected by depth of cut and variations in hardness of recording materials.

Since this cutter is of the crystal-actuated type, the stylus displacement (amplitude) is proportional to the voltages impressed across its terminals over practically its entire frequency range. For this reason, constant amplitude records can be cut without any form of equalization. If desired, commercial constant velocity records may be cut merely through selection of proper coupling circuits to the driving amplifier. The frequency response characteristic is substantially uniform from 50 to 9000 c.p.s.

When connected to the output of an amplifier, the cutter represents a capacity load in which the impedance decreases as the frequency increases. For this reason, it is recommended that a Class "A" or "AB" power amplifier employing triode output tubes be used since the harmonic distortion generated in these tubes is relatively independent of load conditions. Power amplifiers employing pentode or beam power tubes may be used providing they employ a stabilized feedback circuit in the output stage and that the output is shunted with a resistance of suitable value to stabilize the load impedance. Suitable amplifiers will be covered in later articles.

Figs. 5A and 5B show representative circuit arrangements for triode, pentode, and beam power output tubes. These may be connected in single or push-pull arrangement, although the latter is preferable from the standpoint of reducing distortion in the output stage. These diagrams also show connections for loudspeakers in case these may be required for reproducing purposes. The output tubes should be selected to provide an undistorted

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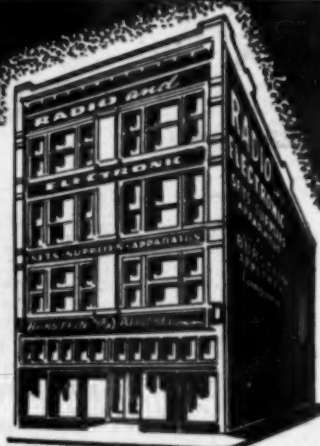
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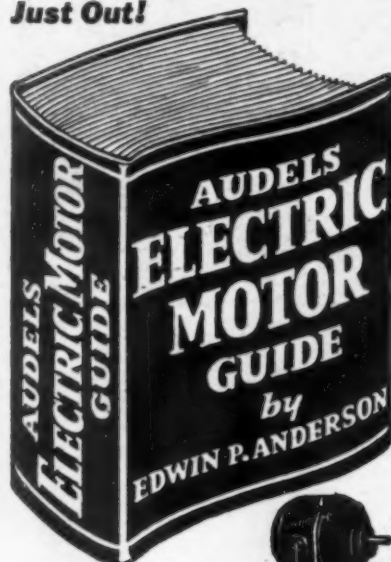
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Since the impedance of the cutter will decrease as the frequency increases, this means that if the cutter impedance is high with respect to its coupling circuit over its entire frequency spectrum, the cutter will operate on a constant amplitude basis.

When the cutter impedance equals the impedance of the coupling circuit, its response will be cut down 3 db. at the frequency where these impedances are equal. Above this frequency, or the turnover frequency, the response will fall off at the rate of 6 db. per octave. In other words, the cutter will operate at a constant velocity basis above the turnover frequency and at a constant amplitude basis below the turnover frequency. By proper selection of circuit components (usually a transformer and/or a series resistor) this turnover can be placed anywhere in the frequency spectrum. If the turnover is located anywhere between 250 and 800 c.p.s., the cutter will engrave commercial constant velocity records. If the turnover is located at the upper end of the frequency spectrum, that is 7000 to 9000 c.p.s., the cutter will engrave constant amplitude records.

The circuit components for engraving

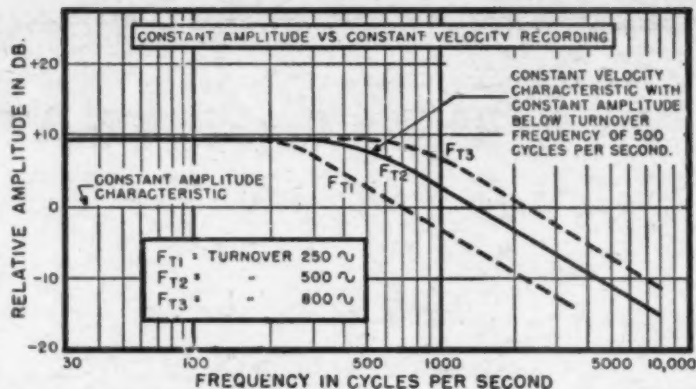
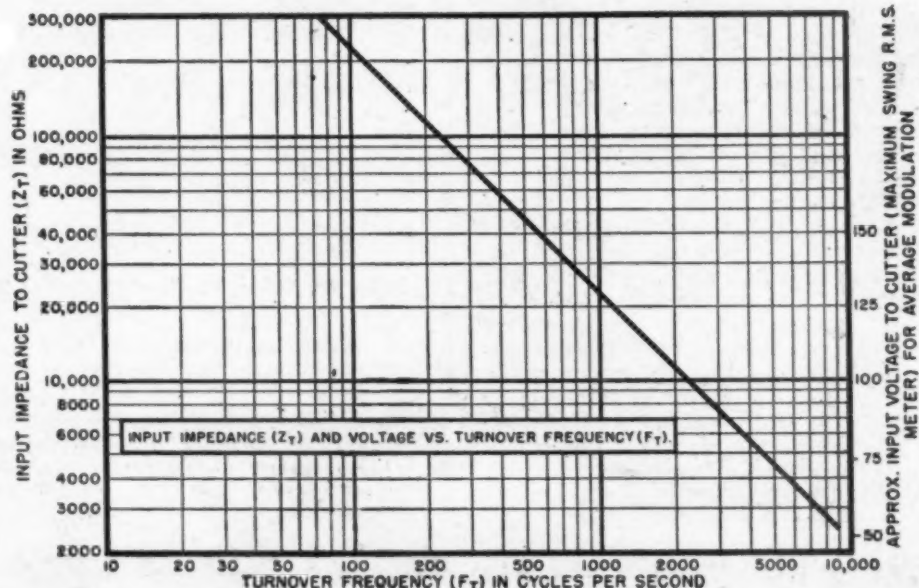


Fig. 6. Curve shows relative amplitude in db. in relation to frequency in c.p.s. for constant amplitude and constant velocity recording.

either constant amplitude or commercial constant velocity records may be selected in accordance with the table shown in Fig. 5. Typical frequency response characteristics for these two types of recordings are shown in Fig. 6.

In the case of constant amplitude recording, the frequency response on an amplitude basis is uniform throughout the frequency range. These records can be reproduced with pickups (such as the Brush Models PL-20, PL-50 and PL-25) without equalization in the reproducing circuit. In the case of commercial constant velocity recording, the frequency response (amplitude basis) is uniform only up to the turnover frequency, usually between 250 and 800 c.p.s. and falls off at the rate of 6 db. per octave above this frequency. These records can be reproduced with the same pickups and other types but equalization is required in the reproducing circuit

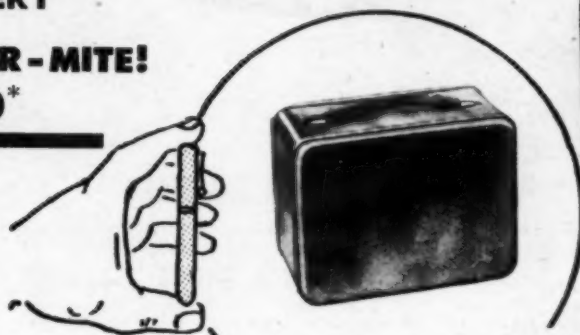
Fig. 7. This chart may be used to obtain the input impedance (Z_T) to the cutter for commercial "constant velocity" recording (See table of Fig. 5). This impedance will vary for the "turnover frequency" selected. The cutting voltage required for average modulation of the record on the basis of the "turnover frequency" may also be obtained from this chart. For example: For a "turnover frequency" of 500 c.p.s. the input impedance (Z_T) to the cutter should be approximately 44,000 ohms. This impedance should be divided between the transformer secondary (sec.) and series resistor, R_s , as in Fig. 5A or lumped as a series resistor, R_s , as in Fig. 5B. For a "turnover frequency" of 500 c.p.s. approximately 150 volts is required for average modulation of the record.



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THE REGAL SUPER-MITE!
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MODEL 747

SIZE:
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- The only set of its size with 5 "A" batteries and 1 "B" battery. Average life —100 hours!
- $4\frac{1}{2}$ " Alnico No. 5 speaker with a heavy duty slug weighing 1.47 oz.
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Specifications:

- ★ Tests by the well-established emission method for tube quality, directly read on the scale of the meter.
- ★ Tests shorts and leakages up to 3 Megohms in all tubes.
- ★ Tests leakages and shorts of any one element AGAINST all elements in all Tubes.
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- ★ New type line voltage adjuster.
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- ★ Works on 90 to 125 Volts 60 Cycles A.C.

Model 450 comes complete with portable cover and all operating instructions.

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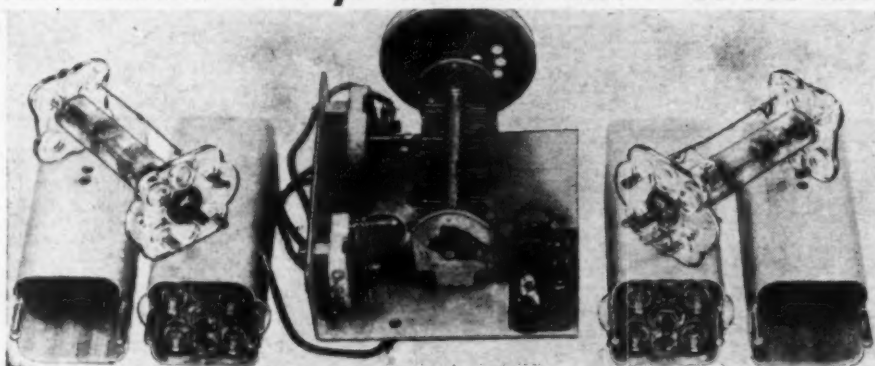
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Immediate Delivery: FM Tuner Kits — 88-108 MC



These FM Tuner Kits have been manufactured by the Pacific Coil Corporation after extensive research by their Radio Electronic Engineers. They are made uniform by prealigning and checking on special testing equipment which is built to duplicate actual operation conditions. This assures that all FM Tuners will be ready for wiring with a minimum of effort. Pacific Coil FM Tuner Kits are designed to operate at the adjustment yielding the highest stability, thus holding at an absolute minimum the tendency to drift.

All IF, Limiter and Discriminator coils are wound on low loss Polystyrene forms to assure the highest gain and stability possible.

Foundation Kit complete with Prealigned Tuning Units
Two IF Coils
One Limiter Coil
One Discriminator Coil
Circuit Diagram
Part No. FM-10.....List Price

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Complete Kit includes Foundation Kit, as at left.
Chassis with all sockets riveted in place, Dial Resistors, Condensers, Hardware, and all other parts to construct a complete FM Tuner.
Part No. FM-11.....List Price

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Less Tubes

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Check Pin Connections & Tube Data Instantly!

Two new and amazingly handy slide rules tell you at once the location and nature of pin connections, filament voltage, filament current, and uses for 176 radio tubes. Radio or electronic engineers, servicemen, students can't afford to be without these pocket-sized time-savers. SEND \$1.00 IN CASH OR MONEY ORDER TODAY and receive both prepaid by return mail. Your money back if not satisfied.

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RADIONIC

Catalog!

to provide a uniform response characteristic. Special filters to accomplish this will be covered later.

In many cases where commercial crystal pickups employing steel needles are used, it may be desirable to cut records with a turnover at some higher frequency than for commercial constant recordings. Since many of these pickups have resonant peaks between 4000 and 5000 c.p.s., a turnover at from 1000 to 3000 c.p.s. may produce a more uniform frequency response. It will be necessary to experiment with the turnover frequency to obtain best results. When records with a high turnover are reproduced with crystal pickups, this will result in a uniform response up to the turnover frequency with attenuation of 6 db. per octave above this frequency.

In constant amplitude cutting the actual impedance from which the cutter operates should not exceed 4000 ohms. This may be obtained from an output transformer as shown in Fig. 5A or by connecting directly to the plates of the output tubes as shown in Fig. 5B. In the latter case the plate resistance (R_p) of the vacuum tube (plate resistance of the two tubes for push-pull) should not exceed 4000 ohms. When a uniform frequency range up to 9000 c.p.s. is required, constant amplitude recording requires approximately 50 volts for average modulation of the record (maximum swing on r.m.s. meter).

In cutting commercial constant velocity, the impedance from which the cutter operates will depend on the turnover frequency selected. This may be obtained from an output transformer and a series resistor as shown in Fig. 5A, or by connecting to the plates of the output tubes through a series resistor as shown in Fig. 5B. For example, by reference to Fig. 7, it will be noted that where a turnover frequency of 500 c.p.s. is required, the cutter should operate from an impedance of approximately 44,000 ohms. This is the cutter impedance at this frequency. Referring to Fig. 5A, this impedance should be divided between the series resistor and the secondary impedance of the output transformer. Generally, these two may be made equal, viz. 22,000 ohms for a turnover of 500 c.p.s. Resistor R_1 should not be smaller than the reflected resistance of the amplifier at A-B, Fig. 5A. In the event that the plate resistance (R_p) for two vacuum tubes in push-pull is 1600 ohms, the output transformer would then have an impedance ratio of 1600 : 22,000 ohms. This corresponds to an impedance ratio of approximately 1 : 13.8 or a turns ratio of 1 : 3.7. Since such an odd ratio transformer may not be easily obtained one having a turns ratio of 1 : 3.5 or 1 : 4 will be found suitable without shifting the turnover frequency seriously. In selecting the output transformer, it is important that there be a sufficient power handling capacity and uniform frequency characteristics throughout its range. When the turnover frequency is be-

RADIO NEWS

tween 250 and 800 c.p.s. commercial constant velocity recording requires approximately 150 volts (maximum swing on r.m.s. meter) for average modulation of the record. See Fig. 7.

It will be noted in Fig. 6 that in commercial constant velocity recording, the lower frequencies are cut approximately 10 db. higher than constant amplitude recording. Constant amplitude can be cut at a higher level for higher record modulation. However, it will be necessary to reduce the frequency range during recording. This can be accomplished by providing a turnover below 9000 c.p.s. much in the same manner as is done at 250 to 800 c.p.s. in the case of commercial constant velocity recordings. For example, if a turnover is selected at 4000 c.p.s., so that only those frequencies below this point are cut constant amplitude, then the voltage applied to the cutter may be increased to approximately 80 volts, (maximum swing on the r.m.s. meter). Lower turnover frequencies will permit higher voltages to be applied to the cutter for higher record modulation. See Fig. 6.

Mounting the Crystal Cutter

To insure good frequency response and a clean cut of constant depth, the following recommendations should be taken into consideration:

1. The mounting bracket for the cutter should be designed so that the pivot point is fairly close to the record plane so as to minimize the effects of any movement which might develop while cutting, due to forces on the record cutting stylus.

2. The pivot point of the mounting bracket should provide free movement to the cutter in a vertical plane. It should, however, be free of play so as to give a stiff support to the cutter against any vibration caused by the lateral motion of the cutting stylus on the record. Needle point bearings are most suitable for this use.

3. Some means for governing the depth of cut should be provided. This may be accomplished by a spring held under proper tension.

4. The moment of inertia should be reduced to a minimum with respect to vertical motion of the cutter. Any mounting weight which will add to the stylus pressure should be kept at a minimum.

5. The cutter may advantageously be completely enclosed within an arm wherever possible.

(To be continued)

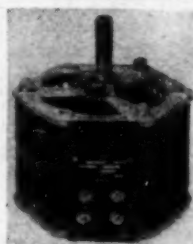
HAMMARLUND HEADS AMATEUR COMMITTEE

LLOYD A. HAMMARLUND, president of the Hammarlund Mfg. Co. of New York, was recently named chairman of the Radio Manufacturers Association Amateur Radio Committee.

Mr. Hammarlund, who succeeds W. J. Halligan as chairman of the committee, will be assisted in this new project by R. C. Sprague, president of Sprague Electric Company who has been named vice-chairman of the committee.

RECTIFIER & BATTERY CHARGER COMBINATION

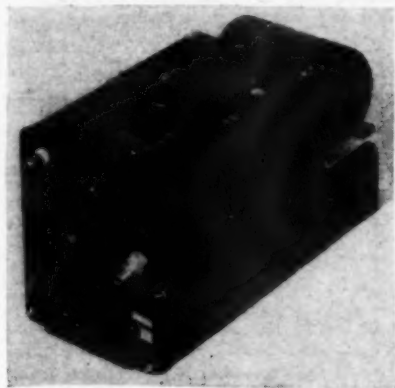
No. RA91A—Selenium plate, full wave 115 or 230v AC; 50-60 cycle, single phase input; output is 6 to 48v DC at 2 to 15 amp; manually controlled, complete with overload input and output switches, 0-15 amp DC meter. Excellent for laboratories, servicemen, service stations. Shipping weight 150 lbs. Price..... **\$39.50**



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SUPERIOR 2 KVA Powerstats; input 115 volts 50-60 cycle—output voltage range 0-135 volts; maximum rated output current 15 amp. available over entire range of output voltage; weight approx. 20 lbs.... **\$29.50**

SUPERIOR 2 KVA 3 1/4 KW powerstats 2 in tandem, each 115 volt AC single phase. Same as the above but twice the input and output voltage..... **\$54.50**



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Receivers of the SCR-274-N/(AN/ARC-5) Series. All-aluminum aircraft receivers 5" wide, 8" high, 12 1/2" long; weight 6 1/2 lbs. Typical tube line-up is: 12SK7 RF, 12K8 Converter, two 12SK7 IF's, 12SR7 Detector and BFO, 12A6 Output, gas-filled antenna-signal voltage limiter, and gas-filled output signal voltage limiter. Each set comes complete with all tubes in sockets. Item 1: 3 to 6 Meg. less dynamotor; Item 2: 6 to 9.1 Meg. less dynamotor. The dynamotor..... **\$1.95**

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With butterfly switch on handle. When the switch is pressed, the microphone is connected into the circuit and an additional set of contacts are closed, to operate a changeover relay. Has a 6-ft. length of cord, with a PL 55 plug for earphone and PL 68 for microphone and switch. Impedance of earphone approx. 2500 Ohm; impedance of microphone approx. 250 Ohm (carbon); connected with batteries it can be used for inter-communication system. They are brand new and the original cost is many times what we are offering them to you... while they last..... **\$3.95**

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This receiver is equipped with a radio frequency sensitivity control, an audio gain control, automatic volume control and an inter-carrier noise suppressor. The audio amplifier is capable of producing zero level db output across a 500 ohm load.

The F3 Receiver is a crystal controlled super-heterodyne receiver consisting of a single stage radio frequency amplifier, an oscillator-mixer, a single stage intermediate frequency amplifier, a second detector and automatic volume control voltage amplifier, and an inter-carrier noise suppressor and audio output stage.

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Made by Gould Storage Battery Corp. 6 volt 15 amp hour. Excellent for amateurs, experimenters, radio servicemen, etc. Shipped dry, with complete instructions for charging. 4 3/4 x 4 3/4 x 6 3/4 high. Shipping weight 12 lbs. While they last. **\$4.95**



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Operation from 110-117 volt, 60 cycle source, power consumed 40 watts. Self contained power supply.

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A combination signal generator and heterodyne wavemeter. It consists of a 5 megacycle crystal-controlled oscillator used as frequency standard calibrator, a variable two-range oscillator, an untuned detector with two stages of audio amplification, a sliding-rod stub antenna, a rough pi-type RF attenuator, a frequency calibration chart and a power supply. Coverage of the test oscillator on the low range setting is from 8 to 15 megacycles; the high frequency range coil covers from 45 to 76 megacycles and since the third harmonic is utilized, this gives a coverage of from 135 to 230 megacycles.

The signal generator cabinet measures 19 1/4" wide, 12" high, 7 1/4" deep; weight 50 lbs. Tubes in BC-1298 Power Supply—16—6SN7GT; 1—5Y3GT/G; 2—6H6; 1—6SA7; 2—6V6GT; 1—6SJ7. Tubes in 1—222-A: 1—6J5; 2—9006; 2—6SJ7; 1—5Y3GT/G. An additional extra power supply and tubes, with many other small items including cables packed in wooden chest is included in this price. Gross wt. of entire equipment 49 1/2 lbs. While they last \$54.50

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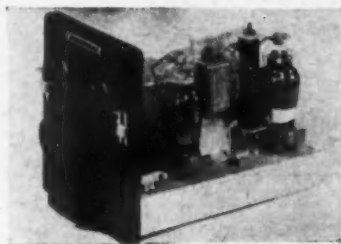
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Battery operated 150-250 Mc. Used to check Hi-Low limits of BC 695 Transponder. Complete with tube, schematic and carrying case. Less Battery. **\$9.95**

TRANSFORMER—PRI 115 volt, 60 cycle; secondary 2.5 volt C.T. 10 amp. 9,000 volt insulation. New. \$3.00

NATIONAL ACN PLANETARY DIAL DRIVE—Ratio 5:1. \$1.00
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Vacuum tube type. HTR volt 6.3—60 second delay; contains RTG 5 amp; in sealed cartons..... **75c**

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The remarkable current generating efficiency of these phones, converts the feeble energy of the voice into electrical energy, capable of carrying for great distances without batteries or any external power source. Use one mike as receiver and one as transmitter. Price for a Brand New pair..... **\$4.00**

**FLEXIBLE SHAFT COUPLING $\frac{3}{16}$ " diam-
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Transformer Design

(Continued from page 59)

Dimension L is equal to:

1.437" dimension B
.050" tube thickness
.050" 25 layers of .002" paper
.300" 25 layers of #29 wire
1.837"

The length of a mean turn of wire is then equal to $K + K + L + L$ or $1.525 + 1.525 + 1.837 + 1.837 = 6.724$ ". The total length of wire is equal to the length of a mean turn times the actual number of turns in the coil which is

$$\frac{6.724 \times 2500}{12} = \frac{16,800}{12} = 1400 \text{ feet}$$

The resistance of No. 29 copper wire is 83.44 ohms per 1000 feet. Then this coil of 1400 feet of wire has resistance of $1.4 \times 83.44 = 117$ ohms, approximately.

The weight of No. 29 copper wire is

SPECIFICATIONS	IRON	STACK
4.5 hy. @ 80 ma. d.c. ..	$\frac{3}{4}$ "	$\frac{3}{4}$ "
5 hy. @ 110 ma. d.c. ..	$\frac{7}{8}$ "	$\frac{7}{8}$ "
5 hy. @ 200 ma. d.c. ..	$1\frac{1}{8}$ "	$1\frac{1}{8}$ "
7 hy. @ 250 ma. d.c. ..	$1\frac{3}{8}$ "	$1\frac{3}{8}$ "
10 hy. @ 110 ma. d.c. ..	1"	1"
18 hy. @ 100 ma. d.c. ..	$1\frac{3}{8}$ "	$1\frac{3}{8}$ "
20 hy. @ 200 ma. d.c. ..	$1\frac{1}{2}$ "	$1\frac{3}{4}$ "
30 hy. @ 20 ma. d.c. ..	$\frac{3}{4}$ "	1"
35 hy. @ 60 ma. d.c. ..	1"	1"

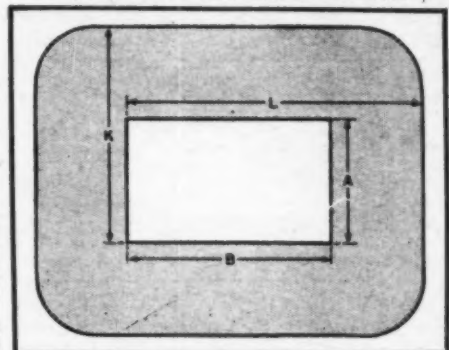
Fig. 13. Approximate core sizes for chokes of various specifications.

0.383 pound per 1000 feet. Then this coil of 1400 feet of wire has $1.4 \times 0.383 = 0.537$ pound of wire in it.

The approximate thickness of the gap to be placed in the magnetic core is shown in Fig. 12. NI/l for our choke is 74.2 and this graph indicates that the air gap should be about .012". This curve will give only approximate values because of variations in different kinds of iron. The proper core gap can be determined experimentally by using the test circuit of Fig. 10. Adjust the load R so that the proper direct current is flowing through the choke. Then simply try different thicknesses of paper in the core gap until you obtain lowest a.c. ripple voltage across the load. Fig. 15 shows how the core is assembled and how the paper gap is placed in the core.

Filter chokes are easy to build be-

Fig. 14. Dimensions used in calculating amount of wire needed in a coil.



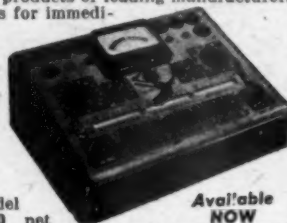
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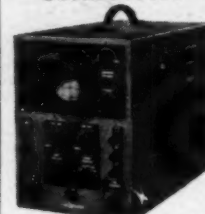
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V. M. Record Changer, 3-Tube Am- plifier and 5" Speaker com- plete in portable case.....	41.95
Complete kit for above.....	34.95

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limiter; rack mounting; complete set spare
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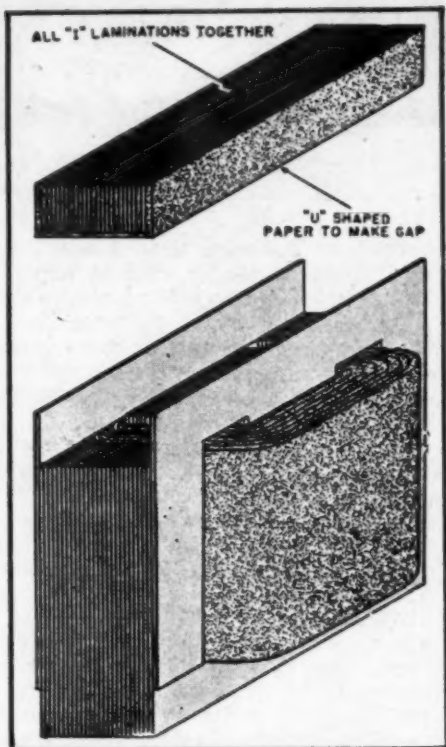


Fig. 15. How core for filter choke is assembled when paper gap is required.

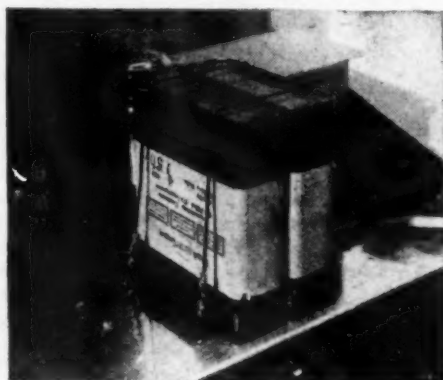
cause they consist of only one winding. With the information contained herein, you can design and construct your own.

(To be continued).

MOUNTING SURPLUS FILTER CONDENSERS

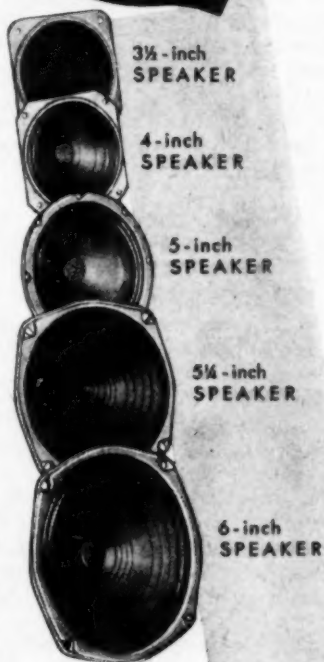
MANY of the excellent surplus filter condensers now on the market are a bit awkward to handle because they are not provided with either mounting feet or rings. The photo shows a simple and inexpensive method of mounting that has proved very satisfactory in transmitter construction.

Holes with plenty of clearance are drilled in the chassis for the terminals and their stand-off insulators. Four No. 25 holes are made also, next to the cans, to take ordinary spade lugs. Short lengths of stranded aerial wire are looped over the condensers and through the lugs, and the latter are then tightened from the underside of the chassis. The condensers are very rigidly supported, yet can be removed in a few seconds merely by loosening the nuts of the spade lugs. . . . D. J. B.



July, 1947

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Crescent Speakers, designed and engineered to the most exacting standards, deliver the finest in tonal performance.

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We carry a complete line of popular brand radio tubes AT BELOW WHOLESALE PRICES. Just send us your order for whatever tubes you need. All tubes 100% perfect, new and fully guaranteed, in cartons. Special prices on large orders.

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- Acorn Tubes: Nos. 954 to 957.....49c
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POPULAR BRAND CONDENSERS

... First Quality—Fresh Stock

ELECTROLYTICS		BY PASS		
		Mfd.	at 400 Volts	at 600 Volts
20/20 @ 150.....	39c			
20 @ 150.....	25c	.001	..	9c
10 @ 450.....	37c	.003	..	9c
16 @ 450.....	53c	.005	..	9c
20 @ 450.....	59c	.01	9c	9c
10 @ 25.....	18c	.02	9c	9c
25 @ 25.....	19c	.03	9c	9c
50/30 @ 150.....	49c	.05	10c	10c
30 @ 150.....	29c	.1	12c	12c
40 @ 150.....	33c	.25	17c	17c

Minimum Condenser Order: 10 Condensers

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- 500,000 OHMS, S.P.S.T. Switch 2" Shaft.....47c
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- 2-Tube Phono Oscillator—Uses 35W4 and 50B5. Packs terrific wallop.....\$4.25
- Kit of 100 Assorted Carbon Resistors, Most Popular Ohmages all at 1/4 Watt. Boxed—per box 100.....1.89
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- Output Transformer for 50L6.....69c
- 6 Ft. Approved AC Line Cord.....25c
- 25 Ft. Hanks / C-DC Antenna Wire.....19c

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- Fresh, Standard brand Portable radio battery, 45 Volts "B".....\$1.39

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Our price ONLY 79c

- "Globe" prices are lowest wholesale prices anywhere.
- 20% Deposit required with all orders.
- We ship anywhere—prompt service on all orders.
- Money back guarantee on all items.
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LETTERS

MINE DETECTORS

IN THE April issue of RADIO NEWS

Mr. Alvin B. Kaufman, in an article entitled "The Modern Diving Rod" states very definitely that the principle of radar has not been used for the detection of buried objects.

"This seems to be in error and Mr. Kaufman should brush up on his radar knowledge as at least nine types of radar mine detectors (transmitted pulse reflected to receiver) were developed by the Allies during the war. Hostilities ceased, however, before the American and Russian versions reached the field.

"Many G.I.s will recall the Australian Mark 7 and 7A mounted on an Army truck, as these were very successful. The latter was a high-powered job and operated on a centimeter wavelength. Both used meter indication.

"I happened to be a senior officer in the Australian Military Forces during the war and was in charge of Army radar there. In '39 and '40 while in England, I worked on a British low-frequency type based on the principles used in their ASDIG (anti-submarine detection indicating gear) and in January, 1940 I flew one of these to Helsinki as at that time Britain was helping the Finns against the Russians.

"In 1943 and 1944 as radar liaison officer to various Allied countries, I was particularly interested in the Russian efforts to improve this same British model, which they had captured from the Finns.

"I can assure Mr. Kaufman that radar metal locators are very practical when vehicle mounted. I happen to own one."

W. E. Osborne
Los Angeles, California

CORRECTION!

WE HAVE read with interest the article in the March, 1947 issue of RADIO NEWS entitled 'Sonar—The Submarine's Nemesis' by C. G. McProud, and are writing this letter to direct your attention to a misunderstanding concerning the ADP crystal.

"In the first column on page 48 is the statement 'The ADP crystal developed during the war by Bell Telephone Laboratories has the same piezoelectric properties as Rochelle salt'."

"Actually, the piezoelectric properties of the ADP crystals differ considerably from those of Rochelle salt, although the general kind of action is the same. The main point we want to make, however, is that the ADP crystal was first introduced by The Brush Development Company not by Bell

Telephone Laboratories. Brush produced and used the crystal experimentally before the war. Early in the war, the superiority of ADP over Rochelle salt for underwater transducer applications was recognized and Brush recommended it to the Navy. The Navy responded enthusiastically and requested The Brush Development Company and the Bell Telephone Laboratories to cooperate in speeding the development of such transducer and methods for the production of large quantities of crystals. Bell Telephone Laboratories assigned some highly qualified men to the job and there was complete exchange of information between the two companies including disclosure by Brush to Western Electric Company of the former's growing methods and plant design. Large scale ADP crystal growing facilities were set up by both The Brush Development Company and Western Electric Company. The Western Electric facilities were dismantled following the war but the Brush facilities are still in operation for commercial as well as government requirements. The Bell Telephone Laboratories and Western Electric Company made many important contributions but so also did The Brush Development Company and since Brush was first to produce ADP, first to recognize its advantages and first to recommend its use and did, to say the least, a substantial part of the development work, we feel that it is quite misleading to refer to ADP as a crystal developed by the Bell Telephone Laboratories."

J. P. Arndt, Jr.
Sales Mgr., Crystal Div.
The Brush Development Co.

Our sincere apologies to The Brush Development Company and our thanks to Mr. Arndt for calling our attention to this error.

CORRESPONDENCE PLEASE

WE, THE members of the Southern Tier Chapter of Radio Servicemen of America, think we have a very good organization for radio servicemen—perhaps our history will be sufficient evidence to prove our point.

"The Binghamton Chapter of IRSM was founded in the fall of 1934 by a delegation from Rochester, New York. We, in turn, helped to organize other chapters in Syracuse, Scranton and Elmira. A member of our chapter was national president in 1936. During the year 1938 IRSM was changed to Radio Servicemen of America and a member of our chapter served on the board of directors and later as vice-president of the national group.

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Send postcard for Free Copies of \$25 **Either** school catalog, full details, all about deferred payment plan, experimental kits, etc. Lincoln Engineering School, Box 931-R102, Lincoln 2, Nebr.

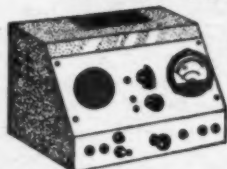
SURPLUS

"BUILD YOUR OWN" and SAVE!

KITS!

RADIO PARTS

BUILD A SIGNAL TRACER



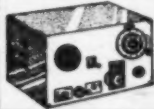
Complete with 1 MA. Meter
\$20 PER KIT
Kit includes everything to build a four-tube signal tracer and volt ohm meter. Built-in detector eliminates use of bulky probe, requiring only ordinary test leads for operation. Output is 3 watts. Power supply already wired in. Bench tested. Similar unit would cost at least triple already made up.

**INTRODUCING! A NEW KIT
2-Tube Broadcast Band T.R.F.**

Kit includes EVERYTHING to build a regular broadcast band radio. This set will do nearly everything that a five tube superhet will do, while using only two tubes. Additional step by step, easy to follow instructions, are included which enable even the beginner to construct this radio. Also ideal for the radio man in his garage or workroom.
Complete with 5" P.M. Speaker
\$6.95 per kit

Build an A.C. 4-Tube Signal Generator

Kit includes everything to build a signal generator. Nine factory wound center tapped coils are included which give frequency range from 200 KC to 50 MC. Cabinet size: 8x8x14. Multi-vibrator circuit included. Power supply already wired. Similar set, made up, would cost at least three times our price.
\$15 Complete per kit



Build a 4-Tube Amplifier

A.C., 4-7 watt, 4 tubes, diagram.
\$12 less speaker per kit
8" JENSEN P.M. SPEAKER with 500 Ohm Transformer
\$6.95



**Radio—F.M.—Television—Electrical Parts
25 Lbs. of USABLE PARTS!**

This kit includes not junk but USABLE PARTS! We have tremendous quantities of many items which would otherwise stagnate in our stock bins, therefore, we would like to pass them on to you at unbeatable LOW PRICES. Kit includes MOTOR, resistors, condensers, coils, sub-assemblies, hardware, etc. Worth many times this price.

10 lb. kit same as above with motor **\$3**

10 lb. kit same as above less motor **\$1.50**

25 LBS. FOR **\$5 WITH MOTOR**
25 LBS. FOR **\$3 LESS MOTOR**

BUILD A CODE OSCILLATOR (Audio)

Kit includes everything to build a code oscillator. Key supplied. Complete less phones, per kit **\$4**

Build a Transmitter

FREQUENCY 2-30 MC
Kit includes everything to build a transmitter. Key included. Complete per kit **\$4**

BUILD AN AMPLIFIER (AC-DC)

Kit includes everything to build a 3-tube 1 1/2 watt amplifier. Ideal for phonograph amplifier. With pre-amplifier for high gain input. Complete per kit **\$5**

Build a S.W. Receiver
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Kit includes everything to build a short wave receiver which operates either phones or speaker. Complete per kit **\$4**

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at SENSATIONALLY LOW PRICES!**

1N5
1N6
6AG5
6B6
6F6
6J6
6K8
6K8
6SA7
6SJ7
6SQ7
6Y6
12AT6
12BA6
35L6
VR150

YOUR CHOICE

50c

YOUR CHOICE
6AB7 6B4
6B8 6J5
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75c

YOUR CHOICE
724B 954
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9006
\$1

2D21 **\$1.50**
2C40 **\$8.00**
2C26 **\$2.50**
3B24 **\$3.00**
6AG7 **\$1.50**
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All items listed above are subject to prior sale. Terms, cash with order F.O.B. Chicago, Ill. Please remit postage charges.
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WALSCO STANDARD TEST RECORD

FOR IMMEDIATE . . . ACCURATE . . . AUDIBLE ADJUSTMENT OF RECORD CHANGERS AND COIN OPERATED PHONOGRAPHS . . . SOLVES THE PROBLEM OF ADJUSTING PICKUP AND TRIPPING MECHANISM THROUGH



- Three Tone lead-in grooves permits immediate adjustment to proper set down position of the pick-up through audible means.
- Made to RMA and NAB standards.
- Record plays in less than 40 seconds.
- Audio tone at end of record indicates proper adjustment of tripping action.

The WALSCO Standard Test Record saves time and increases efficiency in the adjustment of record changers and coin operated phonographs. Write for full information.

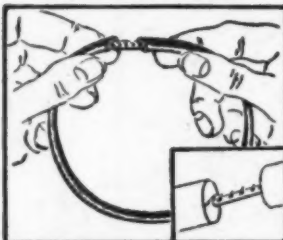
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Will not Slip or Stretch



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Free sample and literature. Write to Dept. 7A

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VOLT-Ohm-MILLIAMMETER
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Television Servicing
(20,000 ohms per volt D.C.)
AC-DC Volts: 0-5000
DC Milliamperes: 10, 100, 500
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"We believe the continuing success of this chapter under adverse conditions has been primarily due to the fact that the control of the organization has been kept exclusively in the hands of qualified radio servicemen. In order to insure this, we have three classes of members, i.e. qualified, associate and honorary members. Only qualified members have a vote and can hold office. All others have a voice in the discussions.

"Our meetings are held the first and third Tuesdays of each month except during the summer months when we have only one meeting per month. The meetings consist of talks by members and also by national engineers. Other activities include banquets, ladies' nights and picnics.

"Our by-laws are revised from the one time national by-laws to suit our conditions. All members comply with them—thus keeping ethics on a high standard in the radio service business in our area.

"Since the end of the war and the return of our old members, activities and membership have increased considerably and are still growing.

"We would like to hear from other organizations of radio servicemen and their activities."

Aaron A. Baldwin, Sec'y
Southern Tier Chapter
Radio Servicemen of America
Binghamton, New York

WE GET AROUND

"WILL you please let me know just where you got the boy's pistols and holsters in the January front cover of RADIO NEWS?"

"Please let me know where I can purchase a pair for my two boys. You will be doing them a good deed for their next Christmas present."

Mrs. S. C. Hanford
Skouriotissa, Cyprus
Mediterranean Sea

I guess boys will be boys the world over—we have forwarded the information to you by letter, Mrs. Hanford.

3" OSCILLOSCOPE

"JUST a line to let you know that the 'boys' around here think the article '3 Oscilloscope' appearing in your March issue is pretty swell. We all agree, however, that one small addition to the unit is necessary. If a jumper wire from the '60 cycle output' terminal was accidentally touched to the case, the 6.3 volt filament winding would be shorted. This would cause damage to the winding if not burn it out completely.

"Since one side of the winding is grounded, the only solution is to insert a current limiting resistor between the 'hot' side of the winding and the '60 cycle output' terminal. The value of this resistor in corresponding commercial scopes ranges from 10,000 to 30,000 ohms at ½ watt. Since little or no current is drawn from the terminal when it is used as a test voltage or sync voltage source, the resistor will have little effect on the voltage.

RADIO NEWS

A .25 μ fd., 600 volt paper bypass condenser from the terminal to ground is also helpful when the terminal is used as a source of sync voltage. This would eliminate transient voltages present in the 110 volt a.c. line from causing improper or shifting syncing of the waveform pattern."

William E. Cranquist
St. Paul, Minn.

This is a good point and many of our readers may want to incorporate this feature in their units.

CONSIGNMENTS?

WE ARE expecting some of the radio tube manufacturers to begin consigning tube stocks to radio shops, as was the practice before the war.

"This will be a direct blow to all the better radio shops throughout the country who have had to purchase their tubes outright during the war, many of them at black-market prices. This will also greatly stimulate the back-yard mechanic and the number of new shops opening up over the country and will also increase the price of tubes and parts to us all because the manufacturer and jobbers will naturally lose money on many of these consignment accounts and must make good on those who are able to keep going.

"It would be well for the shop owners to fight such a plan by any manufacturer or jobber and to voice their objections to their respective jobbers.

"We will not use a tube that is being distributed on the consignment plan and we will not do business with a jobber who is consigning tubes, if there is one we can find who does not."

G. E. Renfroe
Southern Radio Service
Thomasville, Georgia

There are many pros and cons on this consignment problem and some of our readers may not agree with Mr. Renfroe. We do not believe any manufacturer or jobber would institute the "consignment" system if it were unprofitable and they certainly wouldn't penalize one serviceman because they sustained a loss from a consignment shipped to another shop.

PICTORIAL DIAGRAMS

AFTER months of reading about the articles and features your readers would like to see in your magazine, I thought I would send in a few suggestions I think are needed very much, that would help the sales of the magazine, and would fill one of the most important needs of the newcomer and experimenter. I would like to suggest that you include a pictorial wiring diagram of all radio sets but the most advanced type, which are designed for the licensed radio operator and technically trained person.

"I know every inch of space is used up in your magazine, but I believe if some of the space that is used for explaining the technical workings of the set in question were used for the pic-

July, 1947

4 Steps to GREATER PROFITS

1. A complete line of sound equipment for any type of installation that your customers may require. Look at these four outstanding examples!

2. Manufactured with the same skills and experience that make the famous Stromberg-Carlson radios, telephones and telephone switchboards.

3. Consistently advertised for you in: Business Week, Hotel Management, Modern Hospital, Railway Age, American School Board Journal, Nation's Schools and Architectural Record . . . plus a wide range of available point-of-sale material.

4. Nationwide distributor organization to serve you.

SOUND SYSTEM, MODEL SS-750

A completely pre-engineered system. Incorporates AM-FM radio tuner, record changer, controls, provision for wired music, and 90 watts of audio-power divided into four output circuits. Wired for optional remote control turret. All-metal cabinet in glacier-grey finish. Underwriters approved.

PORTABLE SOUND SYSTEM, MODEL PS-32

In a three-section, compact case. 15 watt amplifier with one phonograph and two microphone inputs, two heavy duty Alnico V reproducers, and 25 feet of durable cord with connectors attached. One case has the reproducer receptacle for connecting in cascade. Underwriters approved.

AMPLIFIER, MODEL AR-37

Two input jacks, one provides equalization network for crystal pick up, the other may be bridged across 500-600 ohm circuits without change in level. Treble attenuation and boost, bass boost, bass compensated volume control, separate gain control and fidelity control give the finest in record and wired music reproduction.

AMPLIFIER, MODEL AU-35

One phonograph and three microphone high impedance inputs, separate bass and treble controls, 50-watt divided output with separate master volume controls. Amplifier jack for tandem operation. Hum adjuster, resistor board construction and rugged copper plated steel chassis. Underwriters approved.



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Designed for practically every application required by the Serviceman and Industry. High stabilization through high percentage of feed-back plus fixed bias. True voltage and resistance readings . . . negligible grid current. Long battery life because of low drain electronic circuit and quick-reading meter scale. Light compact construction. For 105-120 AC volt operation.

DC RANGES: 0-3, 10, 30, 100, 1000 volts
(Input resistance: 20 megohms)

AC RANGES: 0-3, 10, 30, 100, 1000 volts
(Input impedance: 5 megohms across 5 mmfd capacity)

(Frequency response: Flat 20 cps-20 KC)
RESISTANCE RANGES: six; 0.1 ohm to 1000 megohms

METER: 200 microamperes DC. Accuracy
+2% of full scale

TUBES: 6SN7, 6H6, 6X5

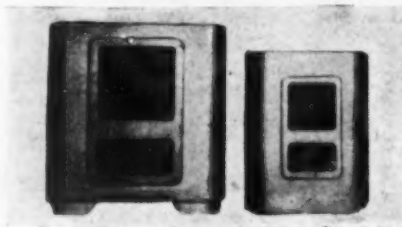
ACCESSORIES: DC cable with prod

AC cable with plug and prod

"Common" cable with plug and clip

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Made of Sturdy Plywood
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torial wiring diagram it would be of more interest as I am sure a great many persons want to build the set and not read all the functions of the circuit.

"Also, why is it that almost always a receiver is designed around home-wound coils when there are many types of ready-wound coils on the market? I would also like to see receivers that are built around tubes that need no power pack so as to get away from so many battery sets and earphones or at least show a power pack to operate the set and not just say how much current it takes to operate it, which does not happen too often.

"Well, I have let off some pent-up steam that has been on my mind for some time and I hope you may give my suggestions a little thought, as newcomers and experimenters such as myself look to magazines like yours to keep up on the new circuits and parts that are coming out and we want to build and use them and want the material so we can understand it as well as a technical person. The answer is pictorial wiring diagrams."

Arthur E. Keeler
White Plains, New York

Thanks for your many suggestions, Mr. Keeler. At present we do not feel justified in sacrificing technical explanations in favor of pictorial diagrams because many of our readers need and use such technical data. We'll keep the idea in mind, though.

-30-

International Short-Wave

(Continued from page 129)

hagen, usually uses a 6-kw. station on 9.520, 1145-1545, weekdays; on Sundays uses 15.320, 0700-1145; has no regularly scheduled English periods.

Egypt—SUX, 7.863, Cairo, is heard in Britain from 1300. (BSWL)

El Salvador—YSN, 7.315, San Salvador, has weak signals on West Coast, 1800-2300; bad CWQRM. (Nankervis)

Finland—OIX4, 15.190, Lahti, broadcasts an English lesson at 0230-0245 on Sundays. (Pearce) News is still broadcast over the 15.19 and 9.50 frequencies at 0715 and 1925. (von Harpe)

France—Paris, 9.560, still directs program to British Isles, 1430-1530, good signal in Britain; lately has been using about 7.280 in parallel. (Pearce) On 7.245 (announced), Paris has English program now at 0930-1030, and is used before and after this period, to European countries. (Harrison) Is heard in Britain on 17.850 opening in French with call of "Ici Paris" at 0830, appears directed to French Indo-China, and signs off at 0930 with "La Marseillaise." (Pearce)

During the summer, North American Service continues on 9.55, 11.845, 2100-2245, news at 2100 and 2230. Good signals in most sections of the Western Hemisphere.

French Equatorial Africa—Radio Brazzaville's 9.984 now has news at 1715, 1830, 1900; the 11.970 frequency



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MIDGET IN SIZE
GIGANTIC IN PERFORMANCE

Strong, stable, accurately calibrated signal available at 456, 465, 550, 1500 kc. AC/DC operation. Perfect for portable or auxiliary use. Complete with tubes, shielded output cable, line cord and plug . . . ready to operate.

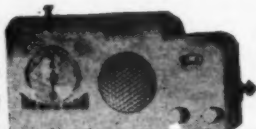
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has news at 1345, 1545, 1645, 1715, 1825, 1900. (Nankervis)

French Indo-China—Saigon's 6.19 and 4.81 frequencies have not been heard recently. (Balbi) Still heard in Australia with news at 0500, on frequencies of 6.190 and 11.780. (Sander-son) The 11.780 frequency has a fair signal here in West Virginia at 0500.

French West Africa—Radio Dakar, about 15.38, appears to sign on at 1445 and off around 1700; news in *French* at 1615; no *English* noted. (Pearce) Widely heard in America.

Germany—AFN, 6.080, Frankfurt, is now on summertime, scheduled 1800-1400, with news at 1800, 1930, 0000, 0300, 0800, 1100, 1300. (Harrison)

Current schedules of the Munich transmitters relaying programs from the United States to Europe are: Munich I, 7.290, 1100-1615; Munich II, 11.870, 1100-1400, and 6.170, 1415-1615; Munich IV, 9.540, 1100-1615.

Hamburg, 6.115, is heard in Britain around 2000-0500 (*not full schedule*); announces as "Nordwest Deutsches Rundfunk, Hamburg"; has woman announcer; only German language noted. (Harrison)

DTSP, 15.105, works point-to-point with New York, 0400-0415; before 0400 has music, but no definite programs. (Harrison)

Hawaii—Current schedules of KRHO, Honolulu, relaying programs from the United States, are: 17.800, 0230-0345; 15.250, 0400-1100; 17.800, 1700-2015, 2030-0100. The 9.650 frequency appears to have been dropped for the summer.

Holland—PCJ, 9.590, Hilversum, sends fine signal to North America in the daily (*except Sunday*) news and commentary session beginning at 2300. (Adey) On 15.22, PCJ is heard on West Coast 0415-0445 most days, to Far East. (Balbi) No changes in schedules for *Happy Station Programs* have been noted.

India—AIR summer schedules, just in via airmail from Delhi, are:

Delhi—VUD2, 10 kw., 7.290, 2100-2300; 9.680, 0200-0400, 1630-0800; 4.960, 0815-1230. VUD3, 5 kw., 9.670, 2040-2245; 17.760, 0125-0130, 0200-0400, 0730-0745; 9.670, 0800-0830, 0845-1130; 6.110, 1200-1245. VUD4, 10 kw., 11.830, 2040-2245, 0125-0130, 0200-0400, 0730-0745, 0800-0830, 0845-1230. VUD5, 100 kw., 15.190, 2040-2245, 2215-0145, 0215-0315, 0345-0830; 9.590, 0900-1100, 1115-1230; 7.290, 1730-1825. VUD7, 100 kw., 15.160, 2150-2200, 2215-0215, 0315-0430, 0500-0945, 1000-1100, 1115-1230. VUD8, 7.5 kw., 21.510, 2215-0215, 0340-0400, 0445-0830, 0900-1110, 1115-1230. VUD9, 7.5 kw., 11.870, 2215-0215, 0340-0400, 0430-0830, 0900-1110, 1115-1230. VUD-10, 2 kw., 9.630, 2150-2200; 17.830, 2215-0215, 0430-0700, 0745-0800; 6.190, 0830-0915. VUD11, 11.760, 2040-2200; 15.290, 2215-0030, 0125-0145, 0200-0400, 0500-0700; 11.850, 0730-0745; 7.290, 0800-0830, 0845-1110; 9.660, 1200-1245.

Bombay—VUB2, 10 kw., 7.240, 2100-2300; 9.630, 0130-0400; 7.240, 0550-0845; 4.880, 0900-1230.

Calcutta—VUC2, 10 kw., 7.210, 2000-

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Madras—VUM2, 10 kw., 7.260, 2030-2130; 9.590, 0200-0430, 0530-0630; 4.920, 0700-1200.

The 15.16 and 9.59 Delhi frequencies are heard on West Coast at 1030 with news. (Balbi)

VU7MC, 6.083, Akashvani, Mysore, scheduled 0330-0445, 0730-1145, 2130-2245. (URDXC)

Iran—EPB, 15.100, Teheran, weak to inaudible early mornings in East; news at 0715; poor modulation. (Kary) Still heard in Britain with news at 0715. (Pearce) Now signs off at 0730. (Legge)

Iraq—HNF, 6.782, Baghdad, is heard in Britain around 1200 with fair level. (BSWL)

Italy—Milan lists 10 kw. power for its 9.630 frequency. (Arthur) Still heard with news at 1900; 11.81 announced in parallel.

Japan—JLW, 7.285, Tokyo, has irregular schedule but when on is usually heard in the early morning hours with AFRS and press work. (Nankervis)

WLKS, British Commonwealth Occupation Forces, Kure, is scheduled on 6.105, 1630-1830, 2100-0500; on 2.465, 0300-0830 but runs to 0900 on Saturday; power is 1000 watts on each channel. (Cushen)

According to URDXC, here are principal Japanese schedules: JVM-2, Tokyo, 9.505, 0325-0830 (full schedule); JVW-4, 9.560, 0325-0830; JKF, 9.655, 1725-0230; JKZ, 9.695, used irregularly, 2200-0230 for special events; JKC, 7.257, 1525-0230, 0255-0830; JKD, 6.015 (AFRN), 1630-0903; JKE, 9.605 (AFRN), 1630-0345; JKA, 7.285, irregularly, 1625-1800, 2200-0230, 0255-0830; JVW, 15.225, 1800-0315; JVW-3, 15.325, 1800-0315; JLP3, 17.835, heard irregularly after 2300.

Java—"The Official Dutch Radio Station in Bandoeng" has final sign-off (in English) after Dutch programs, at 1100; appears not to be on daily; announces use of 10.060, 8.000, 3.015. (Laubscher)

PMA, 19.350, is improving in signal; used 1100-1130 in parallel with 10.365; frequently heard before 1100 and it is possible they are on the earlier transmission of the 10.365 frequency which appears to end around 1050. (Dilg)

The Indonesian on about 14.550 is sending a fair to good signal to the East early mornings; usually identifies in English around 0620. (Kary) Call is YHP; is heard in Australia as early as 0515. (Sanderson)

In South Africa, an Indonesian on 9.555 is heard paralleling PLS, 10.365, mornings; weak but in the clear. (Laubscher)

An Indonesian on 9.68 is being heard irregularly, as early as 0400 to sign-off at 1030, nice signal. May be Soerabaja; the transmitter on 9.55 appears to parallel. (Balbi) Latter is heard at 0500 in Australia, announcing "Hier ist Omproep Batavia." (Sanderson)

An Indonesian on about 12.002 is heard in New Orleans around 0530

RADIO NEWS

with English; may be Bandoeng. (Crandall)

The Indonesians on 14.55 and 7.420 no longer have English at 0900-1000 but at 0530-0630. (Dilg)

Kenya—Nairobi, 4.890 (or 4.885), closes at 1400 except Wednesday and Saturday, when runs to 1500. (Pearce)

Lebanon—FXE, 8.038, Beirut, is heard in South Africa at 1100 with news. (Laubscher) Heard in Belgium as late as 1615. (Salmon)

Luxembourg—Radio Luxembourg, 6.090, now signs off on weekdays at 1630 in French and German, with Luxembourg Anthem. (Harrison)

Malaya—Radio Kuala Lumpur has moved from 6.175 to 6.045; schedule remains the same. (Balbi, Dilg) News at 0900; parallels Singapore's 4.820. (URDXC)

Radio Malaya, 4.820, Singapore, heard in Mexico at 0715; the 6.77 frequency is also heard there same time, but with separate program. (Butcher) Singapore's 4.780 has news read by a woman at 0915. (Ballard)

The Malaya network frequencies of 15.275, 15.300, 11.735, 6.77, appear to now run to 1200. (URDXC)

Mexico—XDA, 14.525, has irregular schedule, usually 0955-1020 and around 2115. (Nankervis)

XEFT, 9.545, Vera Cruz, 1000-0030. (Nankervis)

Mozambique — CR7BU, 4.92, Lour-enço Marques, is heard in Australia at 1600 with musical program.

New Caledonia — According to URDXC, Radio Noumea, 6.160, is now scheduled 0200-0505, 1900-2000.

Newfoundland — VONH, 5.985, St. John's, has transmitter at Mount Pearl, a suburb about 2 miles from St. John's; scheduled 0830-1230, 1630-2100 on weekdays, 1030-1400, 1630-2100 Sunday. (Peddle)

Northern Rhodesia — Mervyn P. Laubscher, ISW Department monitor in South Africa, reports Lusaka on about 9.705, daily to Africans, 1030-1200; the 7.285 and 3.90 frequencies are poor, with bad QRM. In verifying (by letter, cards apparently not used), this station reported that the 31-meter frequency is a new channel and is intended to cover Northern and Southern Rhodesia and Nyasaland, a radius of about 500 miles from Lusaka; "for this reason we are using a type of aerial which suppresses low angle radiation and has a very short skip distance of about 40 miles; the transmitter is a Marconi SWB8 with a power output of 25kw. (NOTE: May mean 2.5 kw.); am rather mystified about your report of our 42-meter channel; actually, we are using only 7.220 (41.5 meters); the 3.914 (76.6 meters) transmission is intended to cover the skip area of the 31-meter transmitter; the power output on both these frequencies is 500 watts." It was stated that IRC's are not necessary. Mr. Laubscher says he, too, is "mystified" regarding the 42-meter

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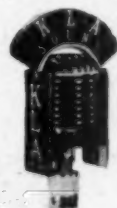


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channel of Lusaka as when logged on what he reads as 7.285, the beam was QRM'd by both Delhi and Munich on 7.290.

Norway—The new Oslo frequency of about 7.210 is heard in Britain paralleling 6.185, 11.735, 9.540 from around 1000; is heard there only when BBC's European Service is not on an adjoining frequency; the 11.735 frequency has been heard opening at 1100; on Sundays opening is before then. (Pearce)

LKJ-2, Fredrikstad, is now off 6.130. (URDXC)

Philippines — KZRH, 9.640, heard 0300-1100; news reports at 0400, 0600, 0730; still asking for reports to Radio Station KZRH, Manila, Philippines. (Nankervis) Full schedule is 1700-1100; news at 0530, 0730, 0900, 1715, 2300, 2345. (Dilg) Now announcing as "The nation's most powerful station." (Gillett)

KZPI has moved from 9.710 to around 9.695. (Baxter, Dilg) Full schedule is 1630-1100, except that on Saturdays runs straight through to 1630 again; this extended schedule is

known as "Pacific Jamboree," and is a request period; uses a 200-watt Techrad, model T-350XM (modified) transmitter, and vertical "L" quarter-wave antenna. (Cushen) News at 1800, 1855, 2345, 0000, 0155, 0600, 0855, 1055. (Dilg) Announces still as experimental. (Gillett)

Poland—Full schedule of *Polskie Radio*, Warsaw, 6.115, is 1100-1801. (Beach) News is scheduled 1550-1610.

Portugal — CSW6, 11.035, Lisbon, heard 1600-1800, in Portuguese only. (Harrison)

Portuguese China—CR8AA, Macao, Radio Clube of Macao, about 9.255, heard with news at 0745. (Nankervis) Signal continues weak. (Dilg) Heard in Mexico as early as 0615, with bad CWQRM. (Butcher)

Radio Macao, which in past used about 7.535 and 7.280, verified by letter, stating that transmitter and other facilities are now in use by CR8AA; new radio gear unobtainable in Macao, but complete equipment is on order from the United States; verified via airmail from Luiz Gonzaga Gomes, acting manager; gave schedule as

The first Midwest television relay link will soon be opened by WBKB to permit Chicagoans to view television programs originating in distant cities. The new installation connects South Bend, Indiana with Chicago. The first experimental antenna of the WBKB relay link towers above the Michigan City, Indiana home of Bill Eddy, director of the station. The gardener's cottage at right is being used to house the equipment which will soon be installed in a regulation control room to be built at the top of three 125-foot towers.



0430-0930 on 9.230; stated "Macao Radio Magazine" is not being published as yet due to newsprint shortage. (Cushen)

In verifying the 7.530 frequency recently for Fred Smith, Ontario, Canada, Mr. Gomes stated that this frequency is no longer in use, but stated was broadcasting on new frequency of 9.300, no schedule given. Attractive card was printed in *English* and it was pointed out they were anxious to receive reports.

Spain—Radio SEU, Madrid, frequency varying around 7.080-7.130, usually about 7.100. (Harrison) Heard with fair level in Newfoundland, 1600-1730. (Peddle)

Madrid, 9.690 (announced), has been heard signing off at 2115; on Sundays has news at both 1500 and 1545. (Nankervis) Is scheduled weekdays with news at 1500.

Sweden—SBO, 6.065 and/or SDB-2, 10.78, are sometimes used for transmitting pictures from Stockholm. (Arthur)

SBT, 15.155, SBP, 11.705, have been heard in Australia at 0200 with *English lesson*. (Sanderson)

Suriname — Paramaribo, 17.677, heard Saturdays, 1200-1255. (URDXC)

Switzerland — Widely reported are the Swiss frequencies directed to North America this summer, which are now daily (including Saturdays). Frequency of 11.865 is used 1730-1815; 9.535, 11.865, 15.315, 2030-2200, and to West Coast, 2200-2230; the 15.315 frequency has powerful signal at 1830 opening to Latin America, interfering badly some evenings with VLA5, 15.32, during latter's 1830-1945 transmission to East Coast.

Among other summer schedules of the Berne (Schwarzenbourg) station are: To Europe, 0020-0140, HER3, 6.165 (100 kw.), HER4, 9.535; 0615-0715, HER4, 9.535, HER5, 11.865 (100 kw.); 1200-1700, HER3, 6.165, HER4, 9.535 (Saturday sign-on is at 1230); Sundays, 0040-0140, HER3, 6.165, HER4, 9.535; 0245-1700, HER4, 9.535, and 0245-0715, 1200-1700, HER3, 6.165. To England daily, 1415-1445, HER5, 11.865. To South America daily, 1645-1715, HEU6, 15.315, and 1830-2000, HER4, 9.535, HER5, 11.865, HEU6, 15.315. To Orient, Monday, Tuesday, Thursday, Friday, 1000-1130, HER6, 15.305, HER7, 17.784. To Near East daily, 1500-1530, HER5, 11.865. To Japan, Friday, 0215-0345, HER7, 17.784, HER6, 15.305. To Australia, Monday, Tuesday, Thursday, Saturday, 0215-0345, HEU5, 11.815, HER5, 11.865. To Africa, daily, 1545-1630, HEU6, 15.315; Saturday, 1000-1200, HER7, 17.784, and 1000-1040 and 1120-1200, HER6, 15.305. (Morck)

Turkey—TAQ, 15.195, Ankara, has been heard in Britain recently around 0900 with dispatches to American networks; announced that broadcast was copyrighted, but that any listener sending in report as proof of reception would receive TAQ's verification card. TAP, 9.465, still has news at 1245 (if now on summertime would be at 1145).

July, 1947

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CHICAGO 22, ILLINOIS

TAP's beam to British Isles, Monday and Thursday, is now at 1530-1545, and the "Postbag" period is heard on Sundays at that time. (Pearce)

United States—Changes to summer frequencies and in schedules are too numerous to list all; however, wider use of the 13-meter band is noted as follows: KCBA, 21.460, 1700-2330; KGEI, 21.490, 2000-0100; WOOW, 21.500, 0730-1630; WCRC, 21.570, 0600-1645; WCDA, 21.570, 1800-2200; WGEA, 21.590, 0600-1645; WNRA, 21.610, 0900-1815; KNBA, 21.630, 1600-1715, 1730-0200; WLWS1/2, 21.650, 0645-1630; WLWS1, 21.650, 1645-0100; WLWK, 21.600, 0645-1300; WNRX, 21.730, 0500-1815; and KCBF, 21.740, 1700-2330.

Uruguay—CXA10, 11.900 Monte-video, 1830-2115. (Nankervis)

Last Minute Tips

An unidentified French-speaking station on about 7.530, heard early mornings, may be *Radio Dalat* or Hanoi, French Indo-China; a similar station on about 9.465 is possibly Hanoi. (Dilg, Baxter) Another possible location for the 9.465 one is Tunis. (Kary) Malacca?

Radio SEAC, 17.770, Colombo, Ceylon, has been heard recently in Pennsylvania carrying the 0730 news. (Kary)

According to Berne List, *Radio Maroc*, Rabat, Morocco, has registered on 6.006, 7.215, 9.575, 11.857, 15.104, 17.812. (Legge, via NNRC)

H.M.S. Vanguard was heard well in Britain during its trip to South Africa, using frequencies of about 7.80 and 13.99 when working BBC. (ISWC) Pat Casey, New York, informs us that the transmitter aboard the *H.M.S. Vanguard* is a Standard Telephones & Cables DS10 for long-range duplex radio-telephony, employing a unit system of construction whereby up to six radio frequency units may be added. This enables up to three of six spot frequencies to be selected for simultaneous operation. The transmitter is capable of providing two c.w. channels at 5 kw. each or 3 c.w. channels at 3 kw. each with separate keying; or 2 c.w. channels at 3 kw. each with common keying. An electronic keying unit is incorporated in the set, permitting operation at keying speeds up to 600 w.p.m. Dimensions are only 6 ft. 6½ inches high, 9 ft. 3 inches long, and 3 ft. 2 inches deep. Five special antennas are on the mainmast and are connected by Pyrotenax feeders to the DS10 transmitter which is installed in a compartment on the port side of the ship; receiving antennas include a single wire and vertical whips, rigged on and around the foremast.

PLS, 10.365, Bandoeng, Java, heard 0700-0900 on Monday, Wednesday, Friday, in addition to daily scheduled 1100-1130. (Nankervis) PLY, 10.060, appears on daily except Sunday, 0500-1045, but runs to 1120 on Saturdays. (Nankervis) Has been heard in South Africa as late as 1115. (Laubscher) PMA, about 19.345, is definitely Bata-

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via; announces "Hier ist Radio Bata-via"; schedule appears 1100-1130, but sign-off varies a few minutes; uses Warsaw Concerto as signature; drifts; usually suffers interference from a French phone station. (Kary)

A Chinese station on about 6.025 is heard mornings on West Coast; ap-pears in dual with XNCR, 7.490, Ye-nan, to 0700; from 0700 to 0800 gives call as XGNC; may be the old Kalgan station moved to Hanton. The Chinese station on 8.660 is presumed to be Kal-gan. (Dilg)

XNCR, 7.490, appears to close around 0700. (Baxter)

XORA, 11.69, Shanghai, is heard in Australia at 0500 with news; XMTA, 12.215, is heard at 0445 there, with news in Chinese, followed by music. (Sanderson)

Bulgaria's Radio Sofia, 9.350, was heard in Nova Scotia recently with news at 1645. (Adey)

According to a Swiss radio publica-tion, the new short-wave center in Czechoslovakia will be the most mod-ern in Central Europe; reported now under construction; to include a new 100-kw. transmitter. (Anderson)

Moscow's evening beam to North America (in English) is now an-nounced for 1820-1930 on 15.44, 15.41, 15.17, 11.63; for 1820-1950 on 11.89; for 1930-1950 on 15.23; however, the 15.17 frequency is heard 1620-1750; news at 1825 and 1930. The Latin American beam from Moscow is heard on 15.41 and 15.36; the Home Service (in Rus-sian), beginning at 2000, employs 11.89 and 11.74. (Beck)

Schedule of HH3W, 10.135, Port-au-Prince, Haiti, with 500 watts power, is 0630-0830, 1200-1500, 1800-2200; Sun-days, 1000-1500. (Casey)

ZEA, 3.660, Salisbury, Southern Rhodesia, is heard at 1400 in Austr-alia with fair level; program is in En-glish to daily sign-off of 1530 with "God Save the King"; signs off at 1500 on Saturday. (Gillett)

HVJ, 11.685, Vatican City, heard re-cently in New York 1500-1545. (Beck)

SUP, 20.135, heard occasionally around 0800 with relay to the United States. (Ferguson) SUV, 10.058, Cairo, has been heard in New Zealand around 1200. (Milne)

JODK, 2.510, Seoul, Korea, is heard in New Zealand around 0730-0800. (Milne)

Radio Makassar, 9.265, is still heard mornings, signal improving. (Dilg)

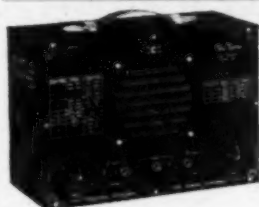
Britain's double summertime (2 hours ahead of GCT) will continue to August 10, when Britain will revert to summertime (1 hour ahead of GCT). (Callahan) British summertime may be continued through winter. (Pearce)

XOPD, 9.555, Hangchow, is heard well in Australia at 0530. (Keast)

Henry Callahan, Philadelphia, has received a verification from Radio Australia based on a recording of a VLC4, 15.32, broadcast in French to Tahiti. Robin Wood, program man-ager, wrote: "I must compliment you on your home recording; quality is very good. Transmitter VLC4, 15.32,

July, 1947

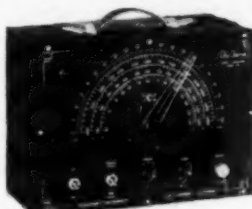
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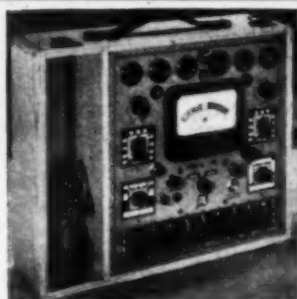
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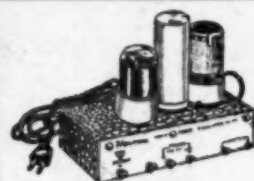
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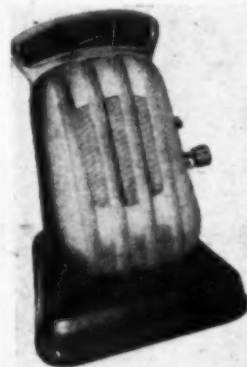
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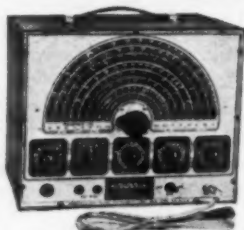
Do not send vibrators unless you believe they can be rebuilt. We rebuild any type or kind of vibrator. Enclose remittance and re-turn postage for prompt service. C.O.D. orders accepted also. Synchronous vibrators rebuilt for \$1.25 ea. Others rebuilt for \$1.00 ea. Old vibrators may be rushed to

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was on a bearing of 99 degrees; this indicates your reception in Philadelphia to be considerably north of the beam, center of which passes almost directly through Guatemala City." Mr. Wood advised that shortly *Radio Australia* will be issuing a pamphlet outlining the history of radio in Australia.

Late tips airmailed from the ISW Dept. listening post of Jack Salmon in Belgium include: PMC, 18.135, Batavia, Java, heard at 1130 with family messages beamed to Holland from members of Dutch forces, signed off at 1135; PMA, 19.350, paralleled. Brussels, 21.450, beams news in French for the press to Leopoldville (following same in Flemish) at 1106; signs off at 1200, but is back on immediately, announcing final sign-off for 1355; has also been heard with music at 0630 and news in French at 0700, relayed from Brussels medium-wave station (I.N.R.). Moscow has been heard on 18.730 with news in French for the press at 1407. Leopoldville's 17.77 has been heard at 1715 with news and commentaries in English. Moscow on 17.765 is heard in English around 1510 and 1840, and in Russian around 0715. CNR-3, 16.666, Rabat, French Morocco, has news in French at 0715. EPB, 15.100, Teheran, Iran, heard at 0600 in oriental language, time signal at 0615. Espana Independiente, U.S.S.R., 13.650, heard at 1135 in Spanish. *Radio Omdurman*, 13.320, Anglo-Egyptian Sudan, heard opening in oriental language at 1130. CS2WI, 12.863, Parede, Portugal, heard around 1520 in Portuguese and with dance music at 1630. Luxembourg, 6.092 (measured), heard at 1520 with variety program.

An AP dispatch from Belgrade, Yugoslavia, reports that short-wave listeners "were astounded recently by a strong Serbian voice of opposition to Premier Marshal Tito's regime, calling "for king and country." The illegal radiocasts apparently originate inside Tito's Yugoslavia, where all regular radio stations and newspapers are controlled by the Government. From the nature of the broadcasts it is apparent the radio is operated by underground remnants of Gen. Draja Mihailovic's Chetniks. Gen. Mihailovic has been executed. Promptly at 6:45 a.m. (time may mean local time), a brief musical phrase has announced the beginning of the radiocast on the short-wave 49-meter band, and a man's voice has said: "This is Radio Ravna Gora of free mountain Yugoslavia—for king and country." Ravna Gora is a large mountain in western Serbia where Gen. Mihailovic and his troops had their headquarters during the war and where he was captured by Tito's men. (Kary)

YV5RX, 3.505, Caracas, Venezuela, signs off at 2230; YV5RW, 3.400, at 2228; and YV5RD, 3.570, at 2230. (Crandall)

Frequencies announced for Moscow's North American beam (in English), 0745-0815, are 9.56, 11.89, 15.17,



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RADIO NEWS

15.41, 17.85, 21.55. Although not announced, a frequency of 17.775 is being heard with extremely strong signals in East; actual sign-on is around 0740 with chimes. (Kary) Batum, 6.490, is heard in Britain in Home Service, 1000-1100. (Harrison) Moscow is heard on 7.270, 2000-2130. (Nankervis) Soviets have dropped 11-megacycle band in Home Service opening at 2200; heard on 15.16, 15.32, 15.275, 17.77, 17.86, last one best signal on West Coast. (Balbi) A Soviet transmitter on 11.75 is heard from 0200 in Chinese, replacing 9.565; may be Moscow or Komsomolsk. (Balbi) Espana Independiente, 6.69, is heard in Britain for 22-minute periods at 0830, 0930, 1030, 1130. (Harrison) The 15.17 frequency is heard in East around 1500 with an Eastern Europe transmission.

Acknowledgment

Sincere appreciation goes to all contributors to this month's listings. K.R.B.

-30-

TROUBLESHOOTING OSCILLATOR CIRCUITS

By NATHAN GREEN

A FREQUENT cause of trouble in a superheterodyne receiver is the failure of the oscillator circuit. This fault may be diagnosed through the use of a signal generator or a vacuum tube voltmeter. However, there is a simple method of accomplishing this without the use of any instruments. This method may be used where instruments are not available or may be employed as a preliminary check prior to undertaking more extensive tests.

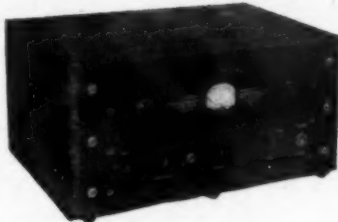
The only equipment required is another receiver which is known to be in good operating condition. The two sets are placed near each other and the set to be tested is tuned to the low frequency end of the dial, say 600 kc. If the dial of set B (the receiver which is being used as the test instrument) is now set at a point corresponding to 600 kc. (or the frequency chosen on the other set) plus the intermediate frequency of set A, a whistling note produced by the oscillator of set A will be heard in the speaker of set B. (The whistling note will not be heard in set B unless this set is tuned to a broadcast station and set A is tuned to a frequency lower than this by the amount equal to the i.f. of set A.) This will indicate that the oscillator of set A is functioning correctly. The i.f. of the set being tested need not be known as it may easily be determined by experiment. Since most modern American receivers have an i.f. between 455 and 465 kc., the signal should be received in set B at between 1055-1065 kc. (if 600 kc. was chosen as the dial setting of set A). This test procedure may be repeated at several points along the scale in order to check the oscillator action at several frequencies. Action of the oscillator cannot be tested at frequencies higher than about 1140 kc. because it will then be out of the range of set B.

It is pretty safe to assume that if the oscillator functions on the portion of the scale from 600 to 1140, it will work all right up to the high frequency end of the dial.

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Hallcrafters S40A	89.50	17.90
Hallcrafters SP44	99.50	19.90
Hallcrafters SX42	275.00	55.00
Hallcrafters HT-9	350.00	70.00
RME VHF-152	86.00	17.32
RME-84	98.70	19.74
RME-45	198.70	39.74
Hammarlund HQ129X	161.40	32.28
Hammarlund SPC400X	334.05	66.81
National NC46	97.50	19.50
National I-10A	67.50	13.50
National NC173	179.50	35.90
National NC240DT or NC240DR	225.00	45.00
National HRO-STAL or HRO-SRA	274.35	54.87
Piercer KP-81	367.65	73.53
Gon-Set Converters	39.95	7.99
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CAPACITY OPERATED RELAY

An intriguing novelty that is of great interest to the experimenter, is a capacity operated relay. Devices of this type are frequently used in conjunction with window displays, to turn lights off and on, actuate moving displays, etc.

Usually the window has a disc of tin-foil mounted on the inside, and the placing of the hand on the outside of the window close to this foil will cause the display to go into action. There are many variations of this type of action such as mounting a metal plate along a counter in such a manner that the approach of a customer will cause a sign to flash or fan to start.

The unit is simplicity itself and most of the parts needed may be found in the junk box. No power supply is needed as the unit works directly off the a.c. line. Any of the sharp cutoff pentodes may be used in place of the 12SJ7 and any beam power output tube used for the 50L6. If a substitution of tubes is made it will be necessary to make the proper changes in the resistance of the line dropping resistor.

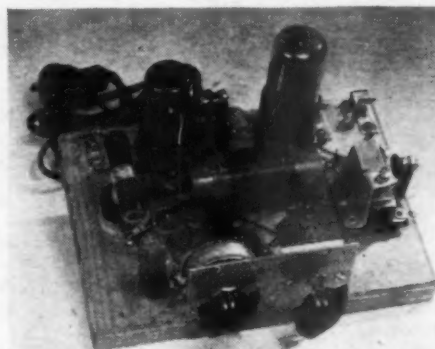
Essentially the unit consists of an oscillator followed by an amplifier. Disturbance of the oscillator by the added capacity of hand or body approaching the metal pickup plate will cause a change in the grid voltage on the amplifier, in turn causing the plate current to increase, closing the relay.

A plywood baseboard measuring five by seven inches is used to mount the parts. Placement is not critical and the parts may be mounted where convenient. A small piece of metal is used to mount the variable condenser and potentiometer. The coil is wound on a bakelite form salvaged from a defunct broadcast receiver.

Care should be taken in wiring as the circuit is quite unconventional. The relay selected should be of the

sensitive type that will close on 5 ma. or less. Many relays of this type are now available at reasonable prices as war surplus.

Most of the sensitive relays are not capable of controlling a great deal of power due to the small current carrying capacity of the contact points. One ampere seems to be a safe figure for



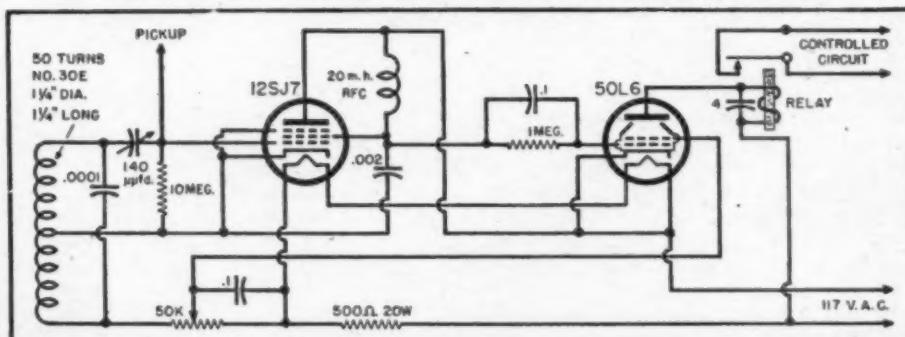
Top-front view of completed unit. To simplify construction, all components are mounted on a 5x7 inch plywood board.

most of these relays. In the event it is desired to control circuits of considerable power, the relay in the unit should be used to control a second relay of sufficient current carrying capacity.

When construction has been completed, the tubes should be put in place and the unit plugged in and allowed to warm up. The variable resistor should be placed at approximately half scale, and the variable condenser rotated. This condenser should be turned slowly until the relay just opens.

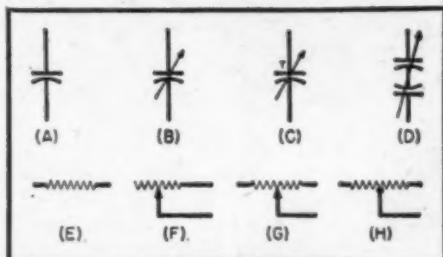
If the unit appears to operate properly, a wire with a pickup plate should be attached to the pickup post. The unit should then be readjusted, so that moving the hand near the plate will cause the relay to operate. The sensitivity of the unit may be adjusted by

Schematic diagram of the capacity operated relay. No power supply is needed.



the potentiometer which varies the screen voltage on the amplifier tube.

The device to be controlled may now be connected to the relay terminals and the unit is ready for use.



Condenser and resistor symbols that are used in diagrams appearing in RADIO NEWS. The symbols shown are used to designate the following types (A) fixed condenser, (B) variable condenser, (C) trimmer condenser, (D) split-stator condenser, (E) fixed resistor, (F) rheostat, (G) potentiometer and (H) tapped resistor.

CATHODES, FILAMENTS AND HEATERS

Are you somewhat confused by the use of the terms cathode, filament, and heater? If so, perhaps this article will help clarify your ideas. We will attempt to explain exactly what is meant by each of the terms, and will discuss some of the variations in construction.

The *cathode* can be briefly described as the primary source of electrons in a vacuum tube. Since electrons flow from negative to positive potentials, the cathode is the negative electrode as opposed to the *anode*, which is the positive electrode. In a rectifier tube, the emission of electrons leaves the cathode with a net positive charge, and a continuous new supply of electrons must flow through the rectifier load to the cathode to replace those which it emits. Therefore, the cathode of a rectifier is always the most positive point in the d.c. circuit.

The *filament* is that element in a vacuum tube through which current flows to produce heat for emitting electrons. In filament-type tubes, the useful electrons are given off directly from the filament; thus it is the primary source of electrons. In the heater-type tubes, to be discussed later, the purpose of the filament is to provide heat, not electrons.

Several types of filaments are in common use at present. Probably the simplest is a pure tungsten wire. Such a filament can be heated to incandescence in order to emit a copious supply of electrons. However, this filament is relatively inefficient; that is, the number of electrons emitted is small in comparison with the power supplied as heat.

It has been found that the efficiency can be greatly increased by coating the tungsten with a very thin layer of thorium. This construction results in what is called a "thoriated tungsten" filament, which gives off many more electrons at much lower temperatures than does pure tungsten. This layer

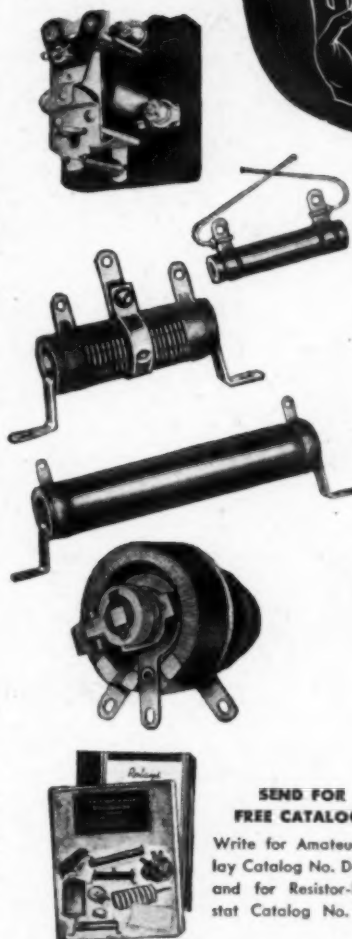
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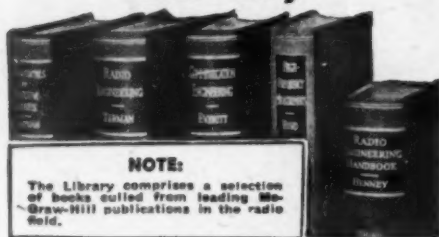
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of thorium may evaporate or become damaged during filament operation, resulting in reduced efficiency. Therefore, some thorium is mixed with the tungsten, and this thorium may be "boiled out" to the surface by operating the filament at elevated temperatures for short periods of time. Such a process is called "reactivation," and could be carried out on several of the older-type tubes, such as the 201-A.

A further increase in efficiency may be attained by coating a tungsten filament with oxides of the alkaline earths such as barium and strontium. Such a filament not only emits much greater quantities of electrons than either of the types mentioned previously, but can be operated at a much lower temperature. Most of the present-day filament-type tubes use this so-called "oxide-coated" type of construction. This filament cannot be reactivated, as there is no way of renewing the oxide layer once it has become damaged.

With the advent of a.c. operation of vacuum tubes, it was found that a great deal of hum was introduced when the filaments were operated on a.c. This was due primarily to the fact that the instantaneous potential between the grid and any one portion of the filament varied in accordance with the a.c. voltage used on the filament. Consequently, the "unipotent" or "heater" type of cathode was developed.

In the heater-type cathode, the electron emitter consists of a sleeve, and the filament, or source of heat, is placed inside this sleeve and insulated from it. In this way, the entire cathode is at the same potential, and difficulties from a.c. hum are minimized. The heater may be operated from an a.c. source without difficulty, since there is no electrical connection between heater and cathode. The cathode sleeve, usually of nickel, is coated with barium and/or strontium oxide in the majority of cases, and so is called an "oxide-coated cathode." Such a cathode will emit an adequate supply of electrons when operated at a dull red heat. The time required for the cathode to come up to operating temperature accounts for the few seconds delay in the operation of most a.c. and a.c.-d.c. receivers after the switch is turned on.

As with the oxide-coated filament, the oxide-coated cathode cannot be rejuvenated, and when emission falls off excessively, the tube must be discarded. The oxide coating may flake off due to mechanical shock, or positive ion bombardment due to excess residual gas may damage the coating. Impurities in the oxide layer will also reduce emission.

In general, only a few volts potential is permissible between the heater and cathode, because of the danger of breakdown of the insulation. However, certain tubes, such as the 6X5, are designed to withstand a heater-cathode potential as high as 450 volts.

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(Continued from page 61)

sufficiently to make sure the whole assembly is making good contact, but not too much or the tip jack will be pushed out through the rubber grommet. Install batteries and the signal generator is ready to operate.

To use, insert a small metal probe, such as a phonograph needle, in the tip jack and touch to antenna, grid, plate or speaker for signal injection wherever desired. The output of this signal generator is very high, something in the neighborhood of 125 volts being read on a vacuum tube voltmeter, when direct connection is made to the tip jack. However, when used on a sensitive receiver there is enough leakage to permit its use without any probe inserted in the jack. Merely hold the tip jack close to the antenna or grid lead and the signal can be heard right through the set. The frequency range is extremely wide, extending from the audio through i.f. and r.f. to the very highs. It was loosely coupled to the antenna of a 144 mc. receiver and sufficient output was available to overload the set at this frequency. It is useful to anyone experimenting with the "ultra highs" as often a signal source is needed to determine the relative merits of different receivers, etc. When using on a dead set, it is suggested that the case of the signal generator be grounded to the set under test, as this will put maximum output into the receiver. The versatility of this instrument cannot be overemphasized for ease of operation, portability, general coverage, with a multitude of uses. It fits in with the modern concept of signal tracing which provides a flexible means of injecting a signal into any component of a radio set and checking its value by aural means, whether it be a single part or a complete receiver. It is not the intention of this writer to give the impression that this gadget will take the place of the tuned signal generator with controlled output, but rather its use is suggested as an auxiliary piece of portable equipment to be used for quick checking.



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Electronic Photo-Timer

(Continued from page 51)

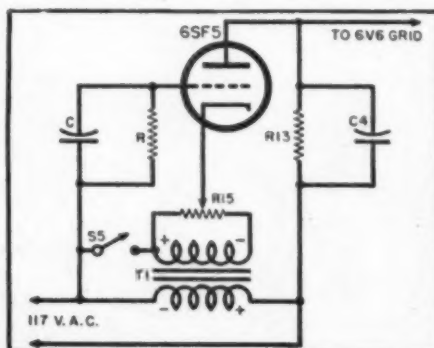
the open front to which the front panel is securely bolted when the timer is installed in the cabinet. The cabinet measures 5 inches by 8 inches by 5 inches deep. Two ¼ inch holes should be punched in the bottom and back of the cabinet to provide ample ventilation. The inside top and bottom views (Figs. 5 and 6), show the construction of the subpanel and general parts layout. The arrangement of the switches on the front panel can be clearly seen in Fig. 1. A back view of the finished timer, showing the a.c. output receptacle, the remote switch receptacle, and the vent holes is also shown in Fig. 1.

If the cabinet is made from galvanized sheet metal, be sure to treat the surface of the metal with acid before painting. This precaution is necessary to secure a good bond between the metal surface and the paint. If the front panel has a crackle finish, this should be removed before painting. A metallic gray shade of Duco applied with a spray gun makes a very attractive finish.

After the paint is thoroughly dry on the front panel, the panel lettering can be engraved by the use of a ¼ inch lettering guide and a sharp scribe which can be purchased at any stationery store. After the letters are scribed into the paint and metal, they can be filled in with a white fingernail pencil, any excess whitening being removed with a damp cloth.

After the timer is finished and installed in the cabinet, it is ready for calibration. Before calibrating, the timer should be turned on for a period of 15 or 20 minutes in order to reach a normal operating temperature. Greatest over-all accuracy results when the timer is set for 55 seconds for calibration. Good results can be obtained by timing a lamp connected to the enlarger outlet. To start with, the calibration control should be set near its midpoint. If on first trial the lamp does not remain on for exactly 55 seconds, the calibration control can be adjusted one way or the other until on succeeding trials the lamp remains on for exactly 55 seconds. This completes the calibration

Fig. 4. Diagram of calibration circuit.



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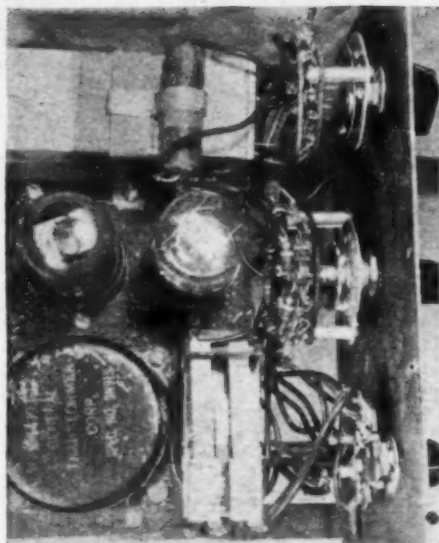
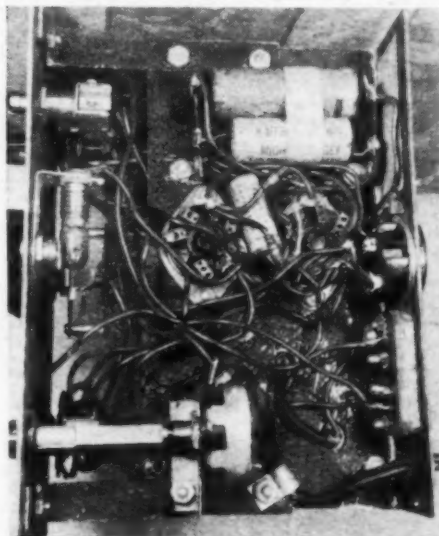


Fig. 5. Inside top view of photo-timer.

for all ranges and any discrepancies on the shorter ranges, due to variations in the individual resistors and capacitors of the timing circuit, will be negligible.

Before operating, the timer should be turned on and allowed to warm up for a few minutes. The next step is to set the "Time Selector" switch and the "Multiplying Factor" switch for the desired time interval. The timing action can be started by either pressing the push-button switch mounted on the front panel or by the use of a remote push-button or foot switch. A two contact receptacle is provided on the back of the timer to which a remotely located push-button switch or foot switch can be connected. A foot switch is particularly useful for starting the timer when a large number of prints are being made from uniform negatives. Whenever it is desired that the timer be turned on for any random length of time, for example while focusing the enlarger, the "Manual-Automatic" switch can be set to "Manual"; however, be sure to return this switch to the "Auto-

Fig. 6. Under chassis view of timer unit.



matic" position when automatic operation of the timer is desired.

Line voltage fluctuations have very little effect on the accuracy of the timer, the reason being, if the line voltage increases or decreases, the calibration voltage also increases or decreases a proportional amount and accurate calibration is maintained. In tests, the line voltage was varied from 100 volts to 130 volts in 5 volt steps with the timer set for 55 seconds. There was no noticeable variation in the time on any of the trials, however, for line voltages below 100 volts the relay action is sluggish and is therefore unreliable on the shorter ranges. The absolute accuracy of the timer is dependent on the accuracy of the resistors and capacitors comprising the timing circuit. For the model discussed in this article, standard capacitors and gold band ($\pm 5\%$) resistors were used

with very satisfactory results. For photographic work, the reset accuracy of the timer is of more importance than the absolute accuracy, and in this respect the timer fulfills the fondest hopes of the most critical photographic worker.

-50-

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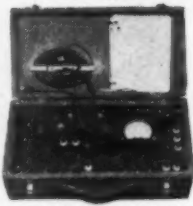
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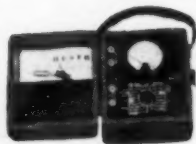
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RADIO NEWS

Local Contact Rig

(Continued from page 53)

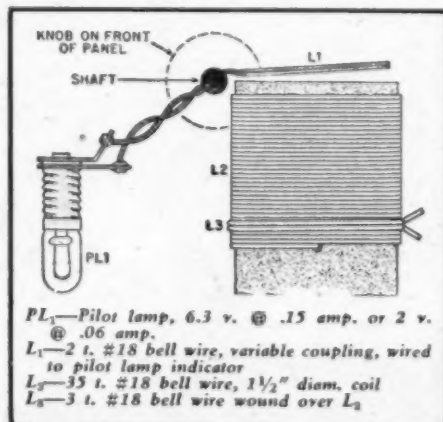
The power supply for the unit is built-in and is of the a.c.-d.c. type. Elimination of the power transformer is a great advantage from the viewpoint of economy as well as making for a more compact outfit. A selenium rectifier is used, being slightly more economical than a tube type and it will undoubtedly have longer life than the tube. The choke used is a fairly husky unit as compared to the rest of the components. It is well to allow a respectable safety factor here since too high a d.c. resistance will be detrimental to the voltage regulation. Even in a transmitter of this size a chirpy signal is undesirable and unnecessary.

The circuit diagram is shown in Fig. 3. The bleeder resistor R_3 may be eliminated if it is not necessary to improve regulation. Since a low resistance choke was used, this resistor was not necessary in our case. The resonance indicator (pilot lamp and pickup loop L_1) are used in the model shown in Fig 1 and no meter is used. In the other version (Fig. 2) the meter only is incorporated for tuning purposes.

While the construction of these two units is very elementary, a few points might be brought out. As will be realized, a great deal of latitude is permissible as far as layout is concerned. If the individual has some other ideas for the physical construction they could be used to good advantage. The two types that were used provide for a choice of space saving dimensions, one for width and the other for depth and both take up a very small amount of bench space. Wood and masonite were used since shielding is far from being imperative in a transmitter of this type and power. Sub-panel construction is used since it presents a better appearance and also is more easily worked than baseboard methods.

When wiring, keep the grid and plate leads short and direct and separated from each other. Most of the body capacity effects can be eliminated if the plate of the 50L6 is

Fig. 4. Coil assembly details.



connected to the stator of the tuning capacitor. No r.f. chokes were found to be necessary although performance might be improved in some cases by the use of one in the plate supply lead at the cold side of the tank coil. Use a 2.5 mh., 60 ma. unit here.

The writer has tried to put over an idea in preparing this article. While it is unquestionably true that few of us see eye to eye with the other fellow on problems like this, it is to be hoped that the writeup is not in vain. If it only starts some of the hams thinking, it will have done some good. Since the reopening of our bands there has been activity on them such as never before. This has resulted in a mad scramble for power augmented by plenty of war surplus power tubes at very low prices. The result of all this is very badly cluttered bands. Vehement opposition would be expected if the FCC decided to cut down our power to, say, 500 or 200 watts. While such a reduction would not be justified, at least from our viewpoint, it would, however, undoubtedly alleviate the present crowded conditions of our frequencies. Since such an action would not be desirable, why not achieve by self-regulation the same results, by a more cooperative use of our power?

-30-

807 Modulator

(Continued from page 46)

plate voltage is 750, or 15,000 ohms for 600 plate volts, 10,000 ohms for 500 plate volts, or 4000 ohms for 400 plate volts.

R_{12} must be set to the exact required resistance value in the following manner. (1) Disconnect 807 screen leads from the top OD3/VR150 tube; (2) Insert 0-50 d.c. milliammeter in screen supply line at point marked "X"; (3) Set slider on R_{12} at such a point that milliammeter indicates exactly 30 ma. Resistor adjustments should be made only when the power supply is switched off. The 807 plate voltages are high enough to be DANGEROUS to the operator. Set the slider and then switch on the power supply for a meter reading. (4) When current of exactly 30 milliamperes is obtained, fasten resistor slider in place, remove milliammeter from circuit, reconnect screen supply line from which meter was removed, and reconnect 807 screen leads to the OD3/VR150 tube.

At no time during operation of the modulator should the glow in the OD3/VR150 tubes cease. If this glow is extinguished at any time, the setting of R_{12} has not been made correctly.

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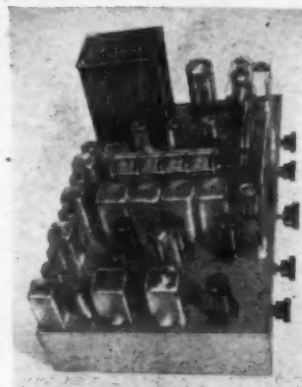
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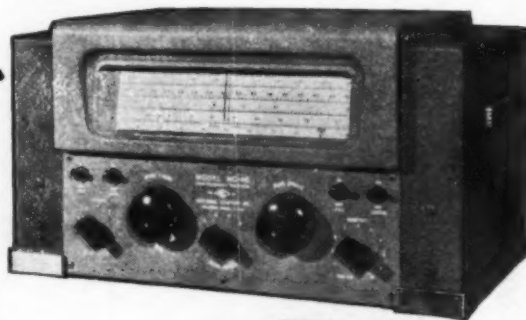
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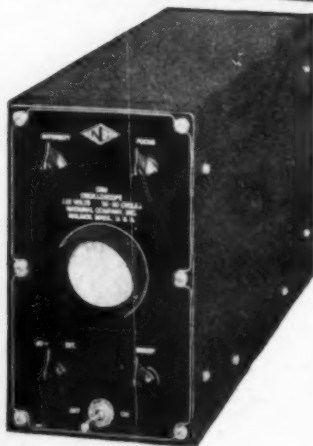
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